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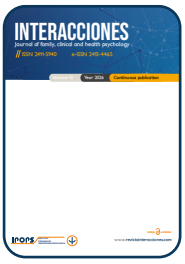

ORIGINAL ARTICLE

Evidence of validity of the 10-item Big Five Inventory (BFI-10) in Peruvian medical students

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ABSTRACT

Introduction: The Big Five model is the most widely accepted theoretical framework for assessing personality traits, with applications in medical education, such as to predict academic performance, burnout, and student well-being. The BFI-10 is an ultra-short 10-item version designed for time-constrained contexts, although it lacks validation in Latin American medical students.

Objective: The objective of this study was to evaluate the evidence of validity of the BFI-10 in Peruvian medical students.

Method: A cross-sectional psychometric validation study was conducted during the 2024 academic year. The sample consisted of first- to seventh-year medical students at the Private University of Tacna (Peru). The factor structure was evaluated using confirmatory factor analysis, measurement invariance by sex and academic phase, internal consistency, and criterion validity against academic performance (continuous GPA) and history of mental-health care.

Results: A total of 248 medical students participated (54.4% women; mean age 22.9 years). The five-factor model showed adequate fit (CFI = 0.968; RMSEA = 0.064) with standardized loadings between 0.71 and 0.89. Measurement invariance held by academic phase and, with caution, by sex (configural RMSEA = 0.098). Internal consistency was acceptable (ω = 0.68–0.86), with Openness the lowest (ω = 0.68). No Big Five dimension correlated significantly with continuous GPA; however, Neuroticism was significantly higher among students with a history of mental-health care (p = 0.004, d = 0.55).

Conclusion: The BFI-10 shows adequate evidence of structural validity and measurement invariance (with caution for sex) in Peruvian medical students. Criterion-validity evidence remains preliminary; the instrument is suitable for group-level research rather than individual, selection, or screening decisions.

Keywords: Big Five Inventory; Personality; Psychometric validation; Medical students; Peru; Medical education.

INTRODUCTION

The study of personality in medical education has gained prominence due to its predictive power regarding various educational and professional outcomes. Within the Big Five model, the most widely accepted theoretical framework for the study of personality traits, conscientiousness emerges as a predictor of academic performance (Mammadov, 2022; Hayat et al., 2020), neuroticism is associated with vulnerability to burnout and other internalizing disorders (Regzedmaa et al., 2024; Bianchi, 2018), and lower neuroticism is associated with greater shared decision-making (Morishita et al., 2025). This body of evidence suggests that personality traits influence not only students' educational trajectories but also their own well-being. Consequently, having valid and feasible instruments to assess personality in this population is essential for both research and the design of support strategies.

The need for brief instruments to assess personality in large-scale research has driven the development of ultra-short versions of the Big Five Inventory. While the NEO-PI-R and the BFI-44 are impractical for multicenter or time-constrained studies, the BFI-10 administers in under a minute and has acceptable psychometric properties in its original version (Rammstedt & John, 2007). However, the BFI-10 has not consistently reproduced the expected five-factor structure across settings: a French validation reported favorable evidence (Courtois et al., 2020), whereas studies in the general Brazilian population (Costa Mastrascusa et al., 2023) and among Indian adolescents (Kunnel John et al., 2019) found poorer structural fit, underscoring that the performance of ultra-short instruments is context-dependent. In Latin America, personality-assessment evidence remains comparatively scarce; adaptations of the Big Five in the Argentine (Genise et al., 2020) and Peruvian (Dominguez-Lara et al., 2018) university contexts illustrate both the regional interest and the need for instrument-specific validity evidence—the Peruvian study validated the 44-item BFI rather than the ultra-short form, underscoring the gap the present study addresses. Specifically for Peruvian medical students, evidence is nonexistent. This limits both large-scale personality research and the potential integration of this instrument into educational decision-making.

Given this gap, the aim of this study was to gather evidence of the validity of the BFI-10 among Peruvian medical students. We evaluated the factor structure using confirmatory factor analysis, measurement invariance across sex and academic phase, internal consistency via alpha and omega coefficients, and criterion validity through associations with academic performance and history of mental-health care. To the best of our knowledge, this is the first study to provide validity evidence for the BFI-10 among Latin American medical students.

METHODS

Design and context

A cross-sectional psychometric validation study was conducted. The data were drawn from a larger study on motivation and choice of medical specialty among medical students at the Private University of Tacna (Peru) in 2024. The Private University of Tacna is a nonprofit institution founded in 1985, located in Tacna, southern Peru, approximately 35 km from the border with Chile (Universidad Privada de Tacna, 2025). It has held institutional accreditation from the National Superintendency of Higher Education (SUNEDU) since 2017 (Limaylla, 2017).

Sample

The study population consisted of 461 students in their 1st through 7th academic years at the School of Human Medicine. A stratified random sample was drawn by academic year. Students enrolled in 2024 who provided informed consent and had completed at least one semester were included; those who incorrectly completed the questionnaire or had missing data on the variables of interest were excluded.

The minimum sample size for the confirmatory factor analysis was determined a priori using the structural-equation-model sample-size method implemented in Arifin's calculator (Arifin, 2017): expected CFI = 0.90; 10 items; 5 factors; average loading = 0.70; average inter-factor correlation = 0.30; $\alpha = 0.05$ (two-tailed); power = 80%. This yielded a minimum of 165 participants (174 allowing for 5% dropout). The final analytical sample (n = 248) far exceeded this requirement.

Variables

10-item Big Five Inventory (BFI-10). Personality traits were assessed using the BFI-10, an ultra-short version designed for time-constrained research contexts (Rammstedt & John, 2007). The instrument assesses five dimensions—Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness—using two items each. Responses use a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). We used the original BFI-10 of Rammstedt and John (2007), with the Spanish wording by Genise et al. (2020); the Brazilian validation by Costa Mastrascusa et al. (2023) is referenced for comparison.

Other variables. Academic performance was operationalized as the self-reported cumulative grade point average on a 20-point scale (0–20) and analyzed as a continuous variable. History of mental-health care was assessed with a dichotomous question on whether the participant had received psychological or psychiatric care at any point in life (yes/no). Sociodemographic variables were age (years), sex (male/female), and academic phase (preclinical/clinical).

Statistical analysis

In the descriptive phase, frequencies and percentages were computed for sociodemographic variables, and mean, standard deviation, skewness, and kurtosis for the BFI-10 items; multivariate normality was assessed with Mardia's test. The internal structure was analyzed with confirmatory factor analysis (CFA) in R 4.2.2 using the lavaan package (Rosseel, 2012). Because each factor is measured by only two items, equality constraints on the loadings within each factor were imposed; this is required to identify two-indicator factors and to avoid improper solutions—indeed, an unconstrained model produced a Heywood case (a negative residual variance) for Neuroticism, confirming the need for the constraint. The Robust Maximum Likelihood (MLR) estimator was used to correct standard errors and fit indices under non-normality (Shi et al., 2021). Fit was assessed

with CFI (> .90), TLI (> .90), RMSEA (< .08), and SRMR (< .08) (Hu & Bentler, 1999). Reliability was estimated with McDonald's omega (Padilla & Divers, 2016); because omega and Cronbach's alpha are limited for two-item scales, we additionally report the inter-item correlation for each dimension as complementary evidence. Measurement invariance across sex and academic phase was tested sequentially (configural, metric, scalar), with ΔCFI ≤ .010 and ΔRMSEA ≤ .015 as equivalence criteria (Chen, 2007). Criterion validity was examined with Spearman correlations (continuous GPA) and Welch's t-tests (mental-health-care history), using factor scores.

Ethical considerations

The study was approved by the Ethics Committee of the Faculty of Health Sciences at the Private University of Tacna (code FACSA-CEI/103-06-24). All participants provided informed consent; anonymity and confidentiality were ensured throughout.

RESULTS

Of 261 respondents, 13 (5.0%) were excluded due to missing data on the variables of interest, yielding an analytical sample of 248. Table 1 shows the sample characteristics: mean age 22.9 years (SD 3.6); the majority were women (54.4%), single (93.1%), and in the clinical phase (55.2%); most reported no psychiatric history (85.1%).

Table 2 shows the inter-item correlation matrix and item descriptives. Within-dimension correlations were the strongest cell for each pair (e.g., BF1–BF2 = .82; BF9–BF10 = .62), while the two Neuroticism items (BF9, BF10) correlated near-zero with all other items, supporting their separation.

The CFA (MLR) indicated adequate overall fit. Multivariate normality was violated (skewness b1p = 20.15, p < .001; kurtosis b2p = 174.33, p < .001), justifying MLR. Fit indices were CFI = 0.968, TLI = 0.951, RMSEA = 0.064 (90% CI: 0.033–0.093), and SRMR = 0.055.

Table 3 shows the factor structure for the five-factor model: Extraversion (BF1, BF2), Agreeableness (BF3, BF4), Openness (BF5, BF6), Conscientiousness (BF7, BF8), and Neuroticism (BF9, BF10). Standardized loadings ranged from 0.71 to 0.89. Inter-factor correlations were high among Agreeableness, Openness, and Conscientiousness (Agreeableness–Openness = .85; Openness–Conscientiousness = .84; Agreeableness–Conscientiousness = .75) and near-zero between Neuroticism and the remaining factors. Internal consistency ranged from ω = 0.68 (Openness) to ω = 0.86 (Extraversion).

Table 4 presents measurement invariance across sex and academic phase. ΔCFI and ΔRMSEA remained within criteria at every step for both grouping variables. However, the configural baseline for sex showed marginal fit (RMSEA = 0.098, above the .08 threshold); therefore, sex-based invariance should be interpreted with caution. Invariance across academic phase (configural RMSEA = 0.077) was more robust.

For criterion validity, no Big Five dimension correlated significantly with continuous GPA (Conscientiousness ρ = 0.10, p = .13; all others |ρ| ≤ 0.07). In contrast, Neuroticism was significantly higher among students with a history of mental-health care than among those without (Welch t = 3.00, p = .004, Cohen's d = 0.55); no other dimension differed significantly by this variable.

Table 1. Characteristics of the sample (n = 248)

Charasteristic	N (%)
Age*	22,9 + 3,6
Sex	
Female	135 (54,4)
Male	113 (45,6)
Marital state	
Single	231 (93,1)
Living together/Married	17 (6,8)
Academic phase	
Preclinical	111 (44,8)
Clinical	137 (55,2)
Psychiatric history	
None	211 (85,1)
At least one	37 (14,9)
Weighted average	
<13	22 (8,9)
13-15	168 (67,7)
>15	58 (23,4)

* Mean + Standard deviation

Table 2. Inter-item correlations and descriptive statistics of the BFI-10 items

Item (dimension)	BF1	BF2	BF3	BF4	BF5	BF6	BF7	BF8	BF9	BF10
BF1 (Extra)	—									
BF2 (Extra)	,82	—								
BF3 (Agree)	,52	,51	—							
BF4 (Agree)	,47	,42	,58	—						
BF5 (Open)	,52	,47	,49	,48	—					
BF6 (Open)	,36	,38	,46	,41	,51	—				
BF7 (Consc)	,41	,30	,42	,36	,49	,55	—			
BF8 (Consc)	,43	,32	,53	,45	,45	,42	,58	—		
BF9 (Neuro)	,03	-,03	,10	-,02	-,02	,09	,06	,14	—	
BF10 (Neuro)	-,07	-,14	-,10	-,07	-,15	0,00	-,09	-,04	,62	—
M	3,46	3,25	4,05	3,96	3,62	3,69	3,84	3,86	3,34	3,26
SD	1,00	1,05	,75	,82	,88	,88	,77	,91	1,04	1,05

Note. Polychoric correlations. Extra = Extraversion; Agree = Agreeableness; Open = Openness; Consc = Conscientiousness; Neuro = Neuroticism. Response range 1–5. Neuroticism items (BF9, BF10) correlate strongly with each other and near-zero with all other items.

Table 3. Factor structure of the BFI-10: standardized loadings, inter-factor correlations, inter-item correlation, and internal consistency

	Item	Extraversion	Agreeableness	Openness	Conscientiousness	Neuroticism
Factor structure	BF1 — talkative, communicative	,89				
	BF2 — sociable, outgoing	,85				
	BF3 — likes to cooperate with others		,80			
	BF4 — helpful, assists others		,73			
	BF5 — original, full of new ideas			,72		
	BF6 — inventive, creative			,71		
	BF7 — does things efficiently				,79	
	BF8 — hard-working, reliable				,72	
	BF9 — gets tense often					,79
	BF10 — gets nervous easily					,79
Inter-factor correlations	Extraversion	—				
	Agreeableness	,63	—			
	Openness	,63	,85	—		
	Conscientiousness	,51	,75	,84	—	
	Neuroticism	-,08	-,01	-,02	,02	—
Reliability	Inter-item r	,75	,58	,51	,58	,62
	Cronbach's α	,86	,73	,68	,73	,77
	McDonald's ω	,86	,74	,68	,71	,77

Note. Robust Maximum Likelihood (MLR). Model fit: CFI = .968; TLI = .951; RMSEA = .064 (90% CI .033–.093); SRMR = .055. All loadings p < .001. Loadings within each factor were constrained equal for identification of two-indicator factors. Openness reliability is below the .70 threshold (see Discussion).

DISCUSSION

Summary of findings

In this psychometric validation study of 248 Peruvian medical students, our main findings were: (1) the five-factor model fits adequately (CFI = 0.968; TLI = 0.951; RMSEA = 0.064; SRMR = 0.055) with loadings from 0.71 to 0.89; (2) measurement invariance holds across academic phase and, with caution, across sex; (3) internal consistency is acceptable (α and ω: 0.68–0.86), with Openness below the 0.70 threshold; and (4) criterion-validity evidence is mixed—no association with continuous GPA, but a significant, theoretically expected association between Neuroticism and history of mental-health care. The BFI-10 therefore shows adequate structural validity and is suitable for group-level research, while criterion-validity evidence remains preliminary.

Strengths and limitations

Strengths include assumption testing (Mardia), MLR under non-normality, a theory-based five-factor model with satisfactory fit, and systematic invariance testing. Limitations: First, invariance subgroups were below the ~200 per group recommended for robust multigroup analysis, and the configural baseline for sex was marginal, so sex-based comparisons warrant caution. Second, the cross-sectional design precluded test-retest reliability. Third, criterion validity relied on a self-reported continuous GPA and a single dichotomous mental-health-care indicator without timing, severity, or validated comparator instruments (e.g., PHQ-9, GAD-7, BFI-44), limiting convergent/discriminant assessment. Fourth, Openness showed reliability below threshold (ω = 0.68; inter-item r = .51), so individual-level Openness scores should be interpreted cautiously and additional Openness items are advisable. Fifth, the high correlations among Agreeableness, Openness, and Conscientiousness (≥ .75) indicate limited discriminant separation; these persisted in an unconstrained model, so they reflect the two-item measurement of these traits rather than an artifact of the equality constraint. Finally, the single-institution sample limits generalizability.

Interpretation of results

Our fit indices were adequate and consistent with the French validation (Courtois et al., 2020), and better than studies reporting poor fit in Indian adolescents (Kunnel John et al., 2019) and the general Brazilian population (Costa Mastrascusa et al., 2023); the small number of items makes structural modeling more demanding, and the BFI-10 is best regarded as a screening or survey tool (Rammstedt & John, 2007). Regarding criterion validity, the conscientiousness–GPA association commonly reported in the literature (r ≈ 0.20; Mammadov, 2022; Hayat et al., 2020) did not reach significance with continuous GPA in our sample, plausibly because medical students already exhibit high, range-restricted performance, and because each dimension is measured by only two items. Importantly, after specifying the factors, Neuroticism was significantly elevated among students with a history of mental-health care (d = 0.55), consistent with neuroticism's well-documented role across the internalizing spectrum (Widiger & Oltmanns, 2017). This provides preliminary criterion-validity evidence for the dimension of greatest clinical relevance, although the dichotomous indicator precludes stronger claims and warrants replication with validated measures.

Implications

To our knowledge, this is the first study to gather validity evidence for the BFI-10 in Latin American medical students. Proximally, the BFI-10 shows adequate structural validity, and invariance across academic phase (and, cautiously, sex) supports group comparisons. Distally, the results offer preliminary support for the cross-cultural validity of the five-factor model in an underrepresented context. At the policy level, current evidence is insufficient to recommend the BFI-10 for selection or screening. The instrument is a feasible tool for characterizing research cohorts; predictive validity (clinical performance, burnout, dropout), convergent validity with longer instruments, and multicenter replication are required before broader use.

Conclusions

The BFI-10 demonstrated adequate evidence of validity based on internal structure and measurement invariance (with caution for sex) among Peruvian medical students, marking the first validation in a Latin American medical population. Structural indices support their use for group-level research. Criterion-validity evidence remains preliminary; the limited and mixed external evidence discourages its use for individual decisions, selection, or mental-health screening. Longitudinal and multicenter studies are needed.

Table 4. Measurement invariance of the BFI-10 across sex and academic phase

Grouping variable	Invariance level	CFI (robust)	RMSEA (robust)	ΔCFI	ΔRMSEA
Sex	Configural	,925	,098	—	—
	Metric	,925	,098	0,000	0,000
	Scalar	,922	,097	-,003	-,001
Academic phase	Configural	,954	,077	—	—
	Metric	,954	,077	0,000	0,000
	Scalar	,957	,071	,003	-,006

Note. Sex: women (n = 135), men (n = 113). Phase: preclinical (n = 111), clinical (n = 137). The configural baseline for sex exceeds the RMSEA < .08 threshold; sex-based invariance should be interpreted with caution.

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AUTHORS' CONTRIBUTION
JAFC: Conceptualization, Methodology, Writing – original draft, Writing – review & editing. BMC: Conceptualization, Methodology, Investigation, Writing – review & editing, Funding acquisition. JHV: Investigation, Methodology, Writing – review & editing. CCC: Investigation, Methodology, Writing – review & editing, Funding acquisition. SYM and CAEF: Investigation, Data curation, Writing – review & editing.

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CONFLICT OF INTEREST
None declared.

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REVIEW PROCESS
This study has been reviewed by three external reviewers in double-blind mode (María Enriqueta Sánchez-Hernández, José Livia, and another reviewer). The editor in charge was Renzo Rivera. The review process is included as supplementary material 1

DATA AVAILABILITY STATEMENT
De-identified data are available from the corresponding author on reasonable request.

DECLARATION OF THE USE OF GENERATIVE ARTIFICIAL INTELLIGENCE
During the preparation of this work, the author(s) used Claude (Anthropic) to review language, adapt the manuscript format, and review citations. After using this tool, the author(s) reviewed and edited the content as needed and take full responsibility for the content of the published article.

DISCLAIMER
The authors are responsible for all statements made in this article.

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