Validation study: Trait Meta-Mood Scale in Nursing, Bogotá - Colombia

Research Article

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Estudio de validación: escala de metaconocimientos sobre estados emocionales en Enfermería, Bogotá - Colombia

Estudo de Validação: Escala Metacognitiva de Estados Emocionais em Enfermagem, Bogotá – Colômbia

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Highlights

- The study validated the instrument among nursing personnel in Bogotá, Colombia, confirming its reliability and validity.
- The analysis of results included a more rigorous reliability analysis model to evaluate the instrument's psychometric properties, employing the Omega coefficient.
- Exploratory factor analysis identified a three-factor solution accounting for 53.7% of the total variance, while confirmatory factor analysis supported the theoretical structure with satisfactory model fit indices.
- The instrument was validated as an effective tool for measuring emotional competencies in nursing, which are essential for professional development and patient care.

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Abstract

Introduction: Nursing staff working in clinical care settings are exposed to multiple stressful situations that test their emotional and psychological resources, affecting the quality of care they provide and their physical and emotional well-being. **Objective:** To validate the Trait Meta-Mood Scale among nursing personnel in order to provide a valid and reliable instrument. **Materials and Methods:** A quantitative, non-experimental study was conducted to evaluate the factorial structure and psychometric properties of the 24-item Trait Meta-Mood Scale (TMMS-24). Data were analyzed using Python and RStudio in a sample of 189 clinical nurses from two healthcare institutions in Bogotá, Colombia. **Results:** Exploratory factor analysis identified a three-factor structure explaining 53.7% of the total variance, providing evidence of construct validity. Confirmatory factor analysis yielded acceptable model fit indices (CFI = 0.910; TLI = 0.897), supporting the instrument's theoretical structure. **Discussion:** The empirical performance of items 23 and 24 should be further examined in comparison with findings from similar studies, as should the theoretical adequacy of item 5, to reduce inconsistencies in sensitivity. It should also be considered the context in which the instrument is applied and include samples with greater geographic diversity to enhance the scale's precision and applicability across different settings. **Conclusions:** The scale was validated as an effective instrument for assessing emotional metaknowledge in nursing, essential for professional development and patient care.

Keywords: Validation Study; Emotional Intelligence; Nursing Staff.

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Estudio de validación: escala de metaconocimientos sobre estados emocionales en Enfermería, Bogotá - Colombia

Resumen

Introducción: El personal de Enfermería del área asistencial, está expuesto a múltiples situaciones estresantes que ponen a prueba sus recursos emocionales y psicológicos, lo que afecta la calidad de la atención de su cuidado, su bienestar físico y emocional. **Objetivo:** Validar la escala de rasgo de metaconocimiento sobre estados emocionales en personal de enfermería, con el fin de proporcionar un instrumento válido y confiable. **Materiales y Métodos:** Investigación cuantitativa de tipo no experimental que evalúa la estructura factorial y las propiedades estadísticas de la escala de rasgo de metaconocimiento sobre estados emocionales versión 24, mediante los lenguajes Python y RStudio en 189 enfermeros/as asistenciales, de dos instituciones de salud de la ciudad de Bogotá. **Resultados:** El análisis factorial exploratorio identificó tres factores que explican el 53.7% de la varianza, confirmando la validez del constructo. El análisis factorial confirmatorio mostró índices de ajuste aceptables, (CFI=0.910; TLI=0.897), lo que respalda la estructura teórica del instrumento. **Discusión:** Es importante revisar la correspondencia empírica de los ítems 23 - 24 con otros estudios similares y la saturación teórica del 5, para disminuir las inconsistencias de sensibilidad, tener en cuenta el contexto de aplicación y la ampliación de muestras de mayor variabilidad geográfica para mejorar la precisión y la aplicabilidad de la escala en diferentes contextos. **Conclusiones:** Esta escala se valida como una herramienta eficaz para medir metaconocimientos emocionales en enfermería, fundamental para el desarrollo profesional y la atención del paciente.

Palabras Clave: Estudio de Validación; Inteligencia Emocional; Personal de Enfermería.

Estudo de Validação: Escala Metacognitiva de Estados Emocionais em Enfermagem, Bogotá – Colômbia

Resumo

Introdução: Os profissionais de enfermagem em ambientes clínicos estão expostos a inúmeras situações estressantes que testam seus recursos emocionais e psicológicos, afetando a qualidade do cuidado prestado e seu bem-estar físico e emocional. **Objetivo:** Validar a Escala Metacognitiva de Estados Emocionais em profissionais de enfermagem, a fim de fornecer um instrumento válido e confiável. **Materiais e Métodos:** Foi realizado um estudo quantitativo não experimental para avaliar a estrutura fatorial e as propriedades estatísticas da Escala Metacognitiva de Estados Emocionais, versão 24, utilizando Python e RStudio. O estudo incluiu 189 enfermeiros clínicos de duas instituições de saúde em Bogotá. **Resultados:** A análise fatorial exploratória identificou três fatores que explicam 53,7% da variância, confirmando a validade de construto. A análise fatorial confirmatória apresentou índices de ajuste aceitáveis (CFI=0,910; TLI=0,897), corroborando a estrutura teórica do instrumento. **Discussão:** É importante revisar a correspondência empírica dos itens 23-24 com outros estudos semelhantes e a saturação teórica do item 5 para reduzir inconsistências de sensibilidade. Deve-se também considerar o contexto de aplicação e a expansão das amostras para incluir maior variabilidade geográfica, a fim de melhorar a precisão e a aplicabilidade da escala em diferentes contextos. **Conclusões:** Esta escala é validada como uma ferramenta eficaz para medir a metacognição emocional em enfermagem, que é fundamental para o desenvolvimento profissional e o cuidado ao paciente.

Palavras-Chave: Estudo de Validação; Inteligência Emocional; Equipe de Enfermagem.

Introduction

In their daily practice, nursing staff face multiple challenges and situations that may lead to high levels of stress, emotional burden, and reduced job performance disminuido[1-3]. Evidence-based nursing has shown that nurses with stronger emotional competencies demonstrate more effective emotion regulation, clearer communication processes, and more effective and accountable decision-making. The development of these competencies directly contributes to improvements in quality, interprofessional collaboration, humanized care, and patient safety[4].

The concept of Emotional Intelligence (EI) was originally proposed by Salovey and Mayer[5], drawing on the theory of multiple intelligences[6], particularly the constructs of intrapersonal and interpersonal intelligence. According to Mayer and Salovey[7], EI is a form of intelligence based on the adaptive use of emotions and their application to thinking.

The proposed EI model is structured around three dimensions: attention to feelings (perception of one's own feelings), emotional clarity (beliefs about the perception of one's own feelings), and emotional repair (individuals' beliefs about their ability to regulate negative emotions)[8]. This proposal inspired the development of the original version of the Trait Meta-Mood Scale (TMMS), which comprised 48 items designed to assess the described factors.

One of the most widely used adaptations of the Trait Meta-Mood Scale (TMMS) condenses the original 48-item instrument into a shorter 24-item version while preserving the original scale's dimensional structure, known as the TMMS-24[9]. This version has been the subject of numerous psychometric studies. In Colombia, the instrument was validated among university faculty in 2019, the general population in 2021, and adolescents in 2025, and it has also been applied to secondary school students. In nursing, the scientific evidence documents its use among both nursing students and practicing settings[10-15]. However, no studies have validated the instrument among clinically practicing nursing staff in Latin America[16-23]. Two studies are particularly noteworthy because of their similarity to the present investigation.

The first study, "A validation of the construct and reliability of an emotional intelligence scale applied to nursing students," was conducted in a Chilean population and confirmed the construct validity and internal consistency of the scale, supporting its use in the population studied[23]. This study is relevant to the present investigation because it provides direct evidence from a nursing population, serving as a foundation for future research integrating both contexts.

Another study considered in the present investigation is "Validity and reliability of the Trait Meta-Mood Scale (TMMS-24) in university faculty," conducted by Angulo Rincón and Albarracín Rodríguez[24] in a Colombian population. This study confirmed the psychometric properties of the Spanish version developed by Fernández-Berrocal et al.[1] while reducing the instrument from 24 to 20 items. This study is relevant because it examined the psychometric properties of the TMMS-24 in a Colombian population and demonstrated that a shorter version of the instrument can be administered, thereby improving its administration efficiency among populations with limited time available to complete it.

Although this instrument has a robust body of empirical evidence, the present study is novel because it focuses on a population that, as previously described, is exposed to working conditions that affect emotional health and may also influence patient care. Accordingly, the objective of this study was to validate the Trait Meta-Mood Scale (TMMS-24) among nursing personnel employed

at two hospitals in Bogotá, Colombia. Its validation will provide methodological input to broaden current understanding and support the development of future studies aimed at improving mental health in this population.

Materials and Methods

Study design

This study employed a quantitative, non-experimental design and was conducted within the field of psychometrics. It evaluated the factorial structure and psychometric properties of the TMMS-24 in a sample of nurses from Bogotá, Colombia. Accordingly, evidence of the instrument's validity and reliability is presented based on the modern theory of validity[25].

Population and sample

The sample consisted of 189 nurses, including women (n=154) and men (n=5), employed at two hospitals in Bogotá, Colombia. The mean age was 31 years for both groups, with a standard deviation of 8.10 years for women and 8.23 years for men. Most participants, both women and men, held permanent employment contracts (63.40%). On average, they had 9 years of professional nursing experience and 5 years of tenure in their current position. The sample size was determined based on the recommendation of Campo-Arias and Oviedo[26], who suggest that validation studies include between 5 and 20 participants per scale item. For the TMMS-24, the sample provided responses from 8.1 participants per item.

Regarding the sampling procedure, because the questionnaires were administered on-site and participants who agreed to take part completed them during their breaks, purposive sampling was used. The inclusion criteria were: (1) being a nursing technician or a registered nurse, and (2) working in a healthcare institution providing direct patient care.

Instruments and variables

The version of the TMMS-24 selected for validation among nurses in Colombia was developed by Fernández-Berrocal et al.[1], who adapted the scale originally designed by Mayer et al.[7] This instrument was validated in a sample of 292 Spanish university students. The validation sample consisted of 84 men and 208 women, aged between 18 and 57 years, with a mean age of 22.6 years (SD=3.9). The Spanish version developed by Fernández-Berrocal et al.[1] retains the three subscales proposed by Mayer et al.[7] However, the instrument's overall length was reduced to 24 items, organized as follows (the minimum and maximum possible scores for each dimension are shown in parentheses):

- Attention to feelings: Items 1, 4, 5, 9, 10, 12, 18 y 19 (8-40).
- Emotional clarity: Items 2, 3, 6, 7, 11, 13, 14 y 21 (8-40).
- Emotional Repair: Items 8, 15, 16, 17, 20, 22, 23 y 24 (8-40).

The instrument is scored using a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree), with higher scores indicating greater development of the ability assessed in each dimension.

Procedure and data analysis plan

The first stage of the study involved obtaining permission to use the version of the TMMS-24 translated and adapted by Fernández-Berrocal et al.[1]. During this phase, the research team contacted the author by email to obtain authorization to use the instrument. Subsequently, to facilitate access to the study

sample, the research project was presented to the bioethics committees of the participating hospitals, and the requested revisions were implemented. For data collection, the printed version of the TMMS-24 was administered on-site together with a sociodemographic questionnaire.

For content validation, five methodological and technical experts evaluated the 24 items in terms of face validity, which refers to the extent to which the items of a scale appear to measure the intended construct. The Content Validity Index (CVI) was also assessed to determine whether the items included in the instrument adequately represented the domains of the construct being measured. The CVI was calculated following the approach proposed by Pedrosa et al.[27], which allows the identification of items requiring revision or retention. A cutoff value of 0.70 was adopted.

To provide empirical evidence of validity, Python was used as the programming language and RStudio as the interface for data analysis and visualization. These tools were used to perform Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA).

Before conducting the Exploratory Factor Analysis (EFA), the Mahalanobis distance was calculated to screen the sample for extreme observations that could affect validity. This analysis enabled the identification of outliers and the assessment of how far individual cases deviated from the center of the distribution. A significance threshold of $p \leq 0.001$ was adopted for this analysis.

In addition, two statistical tests were performed to assess the suitability of the data for factor analysis: Bartlett's Test of Sphericity and the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy. Subsequently, Exploratory Factor Analysis (EFA) was conducted using the minimum residual (MINRES) extraction method.

To facilitate the interpretation of the proposed factors and allow for correlations among them, Promax rotation was applied. To confirm the items' fit to the exploratory model, a Confirmatory Factor Analysis (CFA) was subsequently conducted. In the initial model, the original configuration of all items was retained, with no changes to item placement and no covariance terms added. However, the model fit indices—the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Standardized Root Mean Square Residual (SRMR), and Root Mean Square Error of Approximation (RMSEA)—indicated that the model did not fit the data adequately Table 1.

Table 1. Model fit indices after adding six covariances

Fit index	Result	Reference value
CFI	0.903	>0.90 a 0.95
TLI	0.891	>0.90 a 0.95
χ^2/df	2.04	>3
RMSEA	0.075	<0.5
SRMR	0.058	<0.5
Hypothesis test	0.001	<0.5

CFI: Comparative Fit Index; TLI: Tucker-Lewis Index; χ^2/df, chi-square divided by degrees of freedom (df); RMSEA: Root Mean Square Error of Approximation; SRMR: Standardized Root Mean Square Residual. The hypothesis test indicates the model's validity. These fit indices assess the adequacy of the model to the sample data. The fit indices may vary slightly depending on the estimator and the software used for the analysis; nevertheless, the model demonstrates an adequate fit to the data

Accordingly, a revised model was developed using the modification indices, which suggest potential item reallocations across factors and the addition of residual covariances to improve model fit.

In keeping with the study's purpose, only residual covariances were added, without removing items or reallocating them across factors. The modification indices identified in both Jamovi and RStudio indicated six pairs of items with residual covariances. Following the principle of parsimony, the covariances were added one at a time while monitoring changes in the model fit indices, as shown in Table 1. In addition to preserving parsimony when evaluating changes in model fit, the Bayesian Information Criterion (BIC) was also considered as one of the model fit indices. Finally, the hypothesis test, which evaluates the validity of the model, suggested that the model fit the data well, as the p-value was statistically significant.

The final model incorporated the addition of residual covariances for six pairs of items. The selection of this model was based on a series of key considerations supporting its robustness and suitability for interpreting the data. The complete dataset has been made publicly available through Papyrus[28] for unrestricted access.

Ethical considerations

The informed consent form used in this study was approved by the Institutional Research Ethics Committee, as documented in Meeting Minutes No. 53, dated August 2, 2023. Written informed consent was obtained from all participants.

Results

Regarding content validity, specific findings were identified for two items (Items 20 and 21). These findings underscored the need for targeted revisions to the wording and structure of these items to ensure accurate and comprehensible measurement. Based on the issues identified during the evaluation process, Item 21 of the TMMS-24 was revised due to low levels of comprehensibility, clarity, and precision. In contrast, Item 20 was intentionally left unchanged to evaluate its statistical performance in this context Table 2.

Table 2. Original and revised item

Original item	Revised item
If I overthink things and make them more complicated, I try to calm myself down.	If I am unable to find a solution to my problems and instead make them even more complicated, I try to calm myself down.

The instrument administered included the revised item resulting from the content validity study. Preliminary analyses conducted prior to the EFA identified six outliers using the Mahalanobis distance, based on a significance threshold of $p \leq 0.001$ and the total number of items (24). Based on these results, the six outliers were removed, leaving a final sample of 189 observations. However, the CFA showed that excluding the outliers did not alter the modification indices, and the model fit indices did not deteriorate. Therefore, the outliers were retained because the findings indicated they did not bias the construct structure. Consequently, only residual covariances were added to the model.

Exploratory Factor Analysis

Before conducting the Exploratory Factor Analysis (EFA), sample adequacy was assessed. Bartlett's Test of Sphericity yielded a p-value of 0.0, indicating that the correlations among the items were significantly different from zero and supporting the use of factor analysis. The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy was 0.910, exceeding the recommended threshold of > 0.60, indicating that the data were suitable for factor analysis.

The minimum residual (MINRES) extraction method was used to identify the underlying common factors, followed by Promax rotation. As shown in Table 3, three factors were identified based on the scree plot criterion and the original theoretical structure.

Table 3. Factor loadings

Item	Factor 1	Factor 2	Factor 3
p1			0.587873
p2			0.806728
p3			0.674316
p4			0.624924
p5			0.589764
p6			0.763289
p7			0.767865
p8			0.537473
p9		0.582284	
p10		0.777217	
p11		0.843014	
p12		0.535616	
p13		0.522314	
p14		0.81346	
p15		0.610603	
p16		0.614004	
p17	0.77177		
p18	0.878916		
p19	0.637875		
p20	1.031572		
p21	0.723886		
p22	0.594179		
p23	0.553274		
p24	0.618322		

Test: The minimum residual (MINRES) extraction method was used in combination with Promax rotation

The distribution of the factor loadings presented in Table 3 confirms the theoretically proposed three-factor structure, which explains 53.00% of the total variance. These findings support the instrument's construct validity, providing a reliable measure of the assessed construct.

Confirmatory Factor Analysis

To evaluate the measurement model, the modification indices were examined, as they suggest potential item reallocations across factors and the addition of residual covariances to improve model fit. In accordance with the study's purpose, only residual covariances were added, without removing or reallocating items across factors.

The modification indices identified six pairs of items with residual covariances. Following the principle of parsimony, the residual covariances were added one at a time while monitoring changes in the model fit indices.

This procedure yielded the optimal model. Among the model fit indices, the CFI and the TLI were 0.910 and 0.897, respectively, approaching the values generally considered indicative of good model fit (values > 0.90). In addition, the RMSEA and the SRMR also indicated acceptable model fit.

As shown in Figure 1, the observed factor loadings were high, particularly for the items associated with the Emotional Repair (ER) factor (Items 17–24), suggesting that these items were well represented by their respective factors. The observed correlations, such as 0.61 between ER and Attention to Feelings (AF) and 0.66 between Emotional Clarity (EC) and AF, suggest that these factors were moderately correlated with one another, consistent with the underlying theoretical framework.

Finally, the curved arrows in the diagram represent the variance in the items that is not explained by the model's latent factors. These arrows indicate the extent to which each item is not accounted for by the model, reflecting the discrepancies between the observed and predicted scores. The values associated with these arrows are crucial for evaluating model precision, as smaller residuals indicate that the model explains a greater proportion of the variability in the observed data.

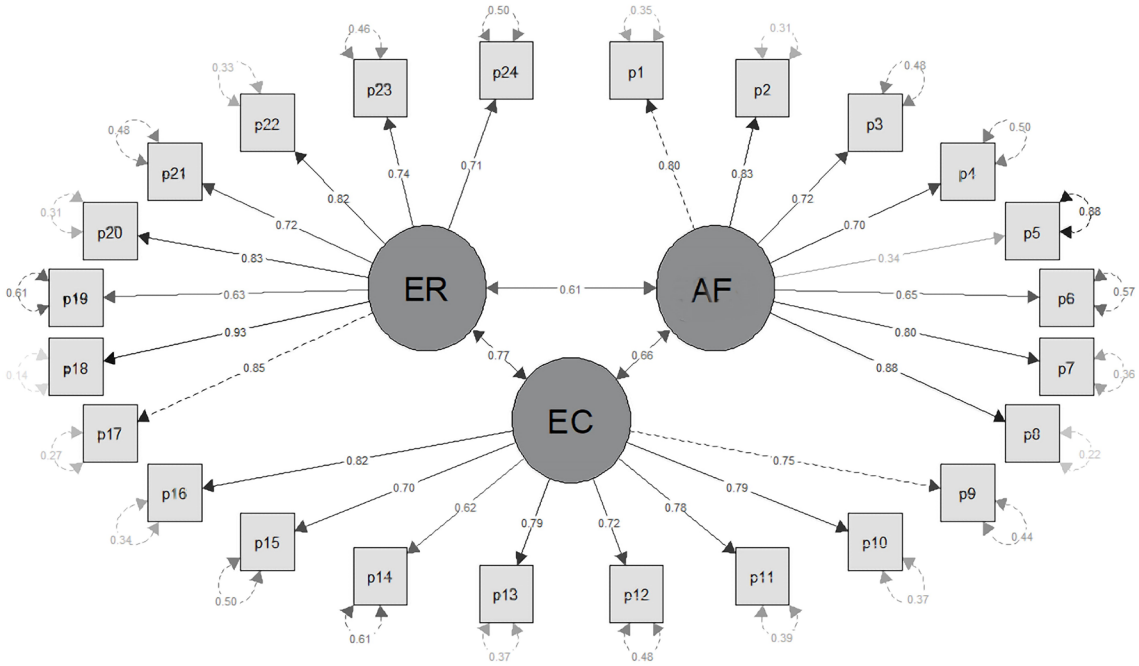


Figure 1. Factor structure path diagram of the TMMS-24 by dimensions
Note. (ER) Emotional Repair; (AF) Attention to Feelings; (EC) Emotional Clarity

Reliability analysis

The reliability analysis showed that both Cronbach's alpha and the Omega coefficient provided valuable information on the internal consistency of the instrument and each of its factors Table 4.

Table 4. Cronbach's alpha coefficients by factor

	Cronbach's Alpha
Attention to feelings	0.882
Emotional clarity	0.893
Emotional repair	0.907

The results presented in Table 4 indicate excellent internal consistency for each factor of the instrument, given that a Cronbach's alpha coefficient greater than 0.70 is considered acceptable.

In addition, the Omega coefficient provides a more comprehensive measure of reliability because it does not rely exclusively on the assumption of unidimensionality and takes into account the factor structure of the instrument, including factor loadings and correlations among factors.

The instrument yielded an overall Omega coefficient of 0.941 and an overall Cronbach's alpha of 0.94, indicating excellent reliability for the instrument as a whole.

Discussion

The TMMS-24 is a widely used instrument for assessing emotional intelligence abilities across diverse settings and professions, including nursing, where these abilities are essential to staff's work performance, as they influence the care provided to users of healthcare services, care management, and relationships within the interprofessional team. Recognizing and strengthening these abilities not only represents a crucial factor in the emotional, psychological, and social stability of healthcare professionals but also contributes to a healthy and efficient work environment[20].

One of the most relevant findings from the literature review concerns the factor loadings of certain items (Items 23 and 24). In the study by Veloso-Besio et al.[22], these items exhibited factor loadings below the recommended cutoff value (0.40). A similar finding was reported by Aradilla-Herrero et al.[2], who suggested removing Item 23 because its factor loading on the construct was lower than that of the other items. It is important to note that this finding warrants further investigation in future studies.

Another issue worthy of discussion, and one that opens avenues for future research, concerns the factor loading of Item 5: *"I let my feelings affect my thoughts"*. In some studies, this item has shown factor loadings below the recommended cutoff value of 0.40[2,24,29,30], whereas in the present study it exhibited a low correlation with the dimension to which it belongs (AF). This finding may suggest inconsistencies in the item's sensitivity across different samples. However, additional statistical analyses are needed to examine this item's performance further.

For the items discussed above, the discrepancies with the findings reported by Aradilla-Herrero et al.[2] and Veloso-Besio et al.[22] may be attributable to certain limitations of the present study, such as cross-cultural bias or the context in which the instrument was administered. Accordingly, future research should expand on this work by including samples with greater geographic variability and qualitative approaches to enable a deeper understanding of the items' performance. In addition, the decision to administer the instrument on-site should be carefully considered in future studies, as completing it in participants' workplaces may introduce social desirability bias, thereby affecting their responses, particularly for items that have demonstrated sensitivity.

Another aspect worth considering is that, across all the studies reviewed, reliability was estimated exclusively using Cronbach's alpha, overlooking the advantages of other methods that have demonstrated greater precision in estimating measurement error. In the present study, internal consistency was assessed using both Cronbach's alpha and McDonald's omega. The latter corrects for the overestimation associated with the instrument and is related to the factor loadings of the items, thereby providing a more accurate estimate of reliability[31]. Although the reliability estimates obtained with both methods were similar in the present study, this may not be the case in all situations.

Conclusions

The evidence of validity and reliability obtained in this study confirms that the TMMS-24 is a valid and reliable instrument for use with nursing personnel in Bogotá, suggesting that it may serve as an effective tool for assessing metaknowledge of emotional states in this specific population. Furthermore, the EFA showed that the TMMS-24 items were appropriately grouped into the three proposed theoretical dimensions: Attention to Feelings, Emotional Clarity, and Emotional Repair, thereby supporting the instrument's factor structure. Likewise, the CFA confirmed the factor structure proposed by the TMMS-24 theoretical model, demonstrating that the items clustered into three dimensions and providing further evidence of the instrument's construct validity.

The validation of the TMMS-24 is particularly relevant for nursing staff because their ability to understand and manage their own emotions may influence both professional practice and patient care. This study validates a tool that can provide an evidence-based foundation for internal institutional client well-being protocols. Likewise, it establishes a basis for its incorporation into policies on humanization, health workforce recruitment, and quality assurance in higher education. As a recommendation for future research, additional analyses are warranted to examine the sensitivity of specific items and their performance across different samples, which may contribute to a better understanding of the TMMS-24's construct validity.

Conflict of Interest: The authors declare that they have no personal, professional, or financial relationships that could have influenced the interpretation or presentation of the results.

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