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Journal of Interprofessional Care

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Submission ID	247550873
Article Type	Empirical Research Articles
Keywords	Interprofessional Relations, Intersectoral Collaboration, Validation Studies as Topic, Surveys and Questionnaires, Physician-Nurse Relations, JSATPNC

Cross-cultural adaptation and validation of the Jefferson Scale of Attitudes Toward Physician-Nurse Collaboration (JSATPNC) in the Spanish context

Abstract.

Interprofessional collaboration between physicians and nurses is a critical aspect of healthcare. The Jefferson Scale of Attitudes Toward Physician-Nurse Collaboration (JSATPNC) is the most widely used instrument for assessing attitudes toward such collaboration. However, this scale has not been validated in Spain. This study aimed to translate and adapt the JSATPNC to the Spanish context and evaluate its psychometric properties.

Following its translation and adaptation, the scale was administered to a sample of 205 primary care physicians and nurses. Construct validity was assessed using confirmatory factor analysis (CFA) and Rasch analysis. The CFA based on the original four-dimensional model demonstrated good fit indices (RMSEA = 0.053, RMSR = 0.037, CFI = 0.974, NNFI = 0.947) and suggested the possibility of a unidimensional model (MIREAL = 0.211). Rasch analysis indicated good fit, except for items 1 and 5. Internal consistency reliability was acceptable (Omega = 0.801 [95% CI: 0.734–0.823]).

The Spanish version of the JSATPNC (JSATPNC-e) exhibits adequate psychometric properties in terms of construct validity and internal consistency reliability. This study provides the Spanish-speaking population with an adaptation of the most widely used instrument for evaluating interprofessional collaboration between nurses and physicians.

Keywords: Interprofessional Relations, Intersectoral Collaboration, Validation Studies as Topic, Surveys and Questionnaires, Physician-Nurse Relations, JSATPNC.

Introduction

Healthcare delivery is widely acknowledged as a process involving the participation of teams composed of various healthcare professionals, often representing multiple disciplines (Gilbert et al., 2010; Walters et al., 2016). Effective communication and collaboration among team members are essential to achieve optimal patient care outcomes (Janssens et al., 2024). Consequently, understanding the establishment and development of collaborative processes, as well as the attitudes and relationships among healthcare professionals within these teams, is a priority area of study (Gilbert et al., 2010; Nagel et al., 2024).

Effective interprofessional collaboration has been shown to improve health outcomes by reducing adverse events, enhancing patient safety, and even lowering mortality rates in certain healthcare settings (Martin et al., 2010; Matthys et al., 2017; Reeves et al., 2017; Pantha et al., 2024). From the perspective of healthcare professionals, effective collaboration is associated with greater job satisfaction, reduced rates of professional attrition, and lower levels of stress and burnout (Ajeigbe et al., 2013; Karakachian & Colbert, 2019; Brown et al., 2023). In this context, the study of interprofessional collaboration between physicians and nurses becomes particularly relevant.

Background

Interprofessional collaboration between physicians and nurses has been examined from various perspectives. Although collaboration ideally rests on equality, mutual trust, respect, and shared responsibility, nurse-physician relationships have historically been characterized by a dominance of the medical profession over nursing (House & Havens, 2017; Hossny & Sabra, 2021). Nurses often report limitations in autonomy and decision-making authority regarding patient care due to the predominant role of physicians in clinical processes (House & Havens, 2017; Parizad et al., 2021). This imbalance frequently leads to conflicts between disciplines, contributing to nurse burnout, professional attrition, and poorer health outcomes (Dall'Ora et al., 2020; Delak & Širok, 2022).

Effective interprofessional collaboration is essential for the optimal functioning of healthcare teams, especially in primary care settings. Here, physicians and nurses must work closely to provide comprehensive care that addresses the needs of individuals and their families within the community (Matthys et al., 2017; Saint-Pierre et al., 2018).

The significance of this topic has driven the development of various instruments designed to assess and measure physicians' and nurses' attitudes toward interprofessional collaboration accurately and reliably (Walters et al., 2016; Peltonen et al., 2020). While some instruments evaluate collaboration among healthcare professionals from different disciplines in general, others focus specifically on physician-nurse collaboration (Dougherty & Larson, 2005; Peltonen et al., 2020). Additionally, these instruments vary in focus, with some

measuring actual collaboration and others assessing perceptions of collaboration (Walters et al., 2016).

Numerous instruments have been developed to study collaboration between physicians and nurses, including the Collaborative Practice Scale (CPS) (Weiss & Davis, 1985), the Collaboration and Satisfaction about Care Decisions (CSACD) (Baggs, 1994), the ICU Nurse–Physician Questionnaire (ICUN-P-Q) (Shortell et al., 1991), the Nurse-Physician Collaboration Scale (Ushiro, 2009), the Nurse-Physicians Collaboration Scale (NPCS) (Caricati et al., 2015), the COPAN scale for collaboration between community nurses and general practitioners (Jaruseviciene et al., 2019), and the Midwifery-Obstetrics Collaboration (MOC) scale (Onibokun et al., 2021). Among these, the Jefferson Scale of Attitudes Toward Physician-Nurse Collaboration (JSATPNC) is perhaps the most recognized and widely used instrument (House & Havens, 2017).

The JSATPNC, developed by Hojat et al. (1999), evaluates attitudes toward physician-nurse collaboration, premised on the idea that interprofessional collaboration is a joint effort with shared authority and responsibility, requiring open communication and shared decision-making.

The JSATPNC has been translated and adapted in numerous countries, including China (Wang et al., 2015), Italy (Caricati et al., 2016), Greece (Malliarou et al., 2020), Turkey (Yildirim et al., 2006), Saudi Arabia (Elsous et al., 2017), Iran (Pakpour et al., 2019), and Brazil (Freire et al., 2018), and has been employed across various care settings and levels (Ward et al., 2008; Zheng et al., 2016; Shields et al., 2022; Dahlawi et al., 2023).

Instruments that assess healthcare professionals' perceptions and attitudes toward interprofessional collaboration are essential for identifying gaps in this area and implementing policies to enhance collaboration, particularly between nurses and physicians, who are primarily responsible for direct patient care. However, to date, no validated instrument exists in Spain to evaluate these attitudes. Therefore, the aim of this study was to translate and adapt the Jefferson Scale of Attitudes Toward Physician-Nurse Collaboration (JSATPNC) to the Spanish context and evaluate the psychometric properties (construct validity and reliability) of the resulting Spanish version.

Methods

This study was conducted in two stages:

Stage 1: Methodological Study

Translation and Cross-Cultural Adaptation

The English version of the Jefferson Scale of Attitudes Toward Physician and Nurse Collaboration (JSAPNC) was translated and culturally adapted to Spanish, following the phases outlined by Sousa & Rojjanasrirat (2011). The process involved:

1. Consent and Collaboration: Permission and collaboration were obtained from the original authors at Thomas Jefferson University.
2. Forward Translation: Two independent bilingual professional translators translated the instrument into Spanish. The research team compared both translations, discussing discrepancies and creating a preliminary Spanish version (v1 JSAPNC-e).
3. Back Translation: Two additional independent translators, unaware of the original instrument, back-translated the preliminary version into English. The research team, alongside the original authors, evaluated these back-translations for fidelity and discrepancies, leading to the development of a second preliminary version (v2 JSAPNC-e).

Face Validity

The v2 JSAPNC-e was pilot-tested with the target population to assess comprehension, applicability, administration time, and cultural appropriateness. Participants identified unclear items and rated the instrument's importance and utility on a 4-point Likert scale (1 = "Not useful or important" to 4 = "Very useful or important"). The comprehensibility of the v2 JSAPNC-e was evaluated using the INFLESZ scale (Barrio-Cantalejo et al., 2008), which classifies text readability as: Very Difficult (0–40), Somewhat Difficult (40–55), Normal (55–65), Fairly Easy (65–80), and Very Easy (80–100).

Stage 2: Cross-Sectional Validation Study

Study Design

A cross-sectional study was conducted to validate the Spanish version of the JSAPNC-e, focusing on construct validity and internal consistency reliability.

Study Population

Participants were physicians and nurses from primary care teams across Gran Canaria, Lanzarote, and Tenerife (Canary Islands, Spain). Midwives were excluded from the study.

Sample Size

A minimum sample size of 200 participants was estimated based on the classic recommendation of at least 10 subjects per instrument item. To ensure representativeness, a minimum participation rate of 30% from each professional group (physicians and nurses) was targeted.

Variables, Instrument, and Data Collection

Sociodemographic variables included age, gender, years of professional experience, profession (physician/nurse), country of professional education, highest academic degree, possession of a specialty, and type of specialty. Data were collected through a secure online survey platform (EU Survey©) distributed via institutional websites. The survey included two parts: an "*ad hoc*" section for

sociodemographic data and the JSAPNC-e items. Data collection occurred from October 2023 to June 2024.

Data Analysis and Interpretation

- Descriptive Analysis: Categorical variables were expressed as percentages and frequencies, while Continuous variables were presented as means, standard deviations, and ranges. Item skewness and kurtosis values were also calculated.
- Construct Validity: A confirmatory factor analysis (CFA) was conducted based on the original four-dimensional model proposed for the JSAPNC scale. Data adequacy for the factor analysis was assessed using the Kaiser-Meyer-Olkin (KMO) index and Bartlett's test of sphericity. Pearson's correlation matrix was employed for factor extraction, using Robust Unweighted Least Squares (RULS) as the extraction method, combined with Orthogonal Procrustes rotation.

  Parallel analysis was performed to determine the number of factors to retain, and the consistency of the retained factors was calculated. Confidence intervals (95%) for item scores and model measures were estimated through bootstrapping.

  The adequacy of the factorial solution was evaluated using the following fit indices (Ferrando et al., 2022):
  - Root Mean Square of Residuals (RMSR): Kelley's criterion was applied, where the RMSR value is compared to the typical error of a zero correlation in the population.
  - Root Mean Square Error of Approximation (RMSEA): Values below 0.05 were considered indicative of good fit, while values between 0.05–0.08 represented a reasonable fit.
  - Non-Normed Fit Index (NNFI) and Comparative Fit Index (CFI): Values of 0.95 or higher were indicative of good model fit.
  - Goodness of Fit Index (GFI) and Adjusted Goodness of Fit Index (AGFI): Values above 0.90 were considered indicative of good model fit.

  Additionally, the unidimensionality of the model was assessed using the Unidimensional Congruence (UniCo), Explained Common Variance (ECV), and Mean of Item Residual Absolute Loadings (MIREAL) indices. According to Lorenzo-Seva and Ferrando (2018), the following thresholds were applied to determine whether the data could be considered essentially unidimensional:

  - UniCo > 0.95: Indicates strong unidimensional congruence.
  - ECV > 0.85: Suggests a high proportion of variance explained by a single factor.
  - MIREAL < 0.30: Reflects low residual item loadings, consistent with unidimensionality.

The consistency of each factor was assessed using the ORION coefficient (Overall Reliability of fully-Informative prior Oblique N-EAP scores) and the Factor Determinacy Index (FDI). Additionally, the Sensitivity Ratio (SR) and the Expected Percentage of True Differences (EPTD) were calculated:

- Sensitivity Ratio (SR): Indicates the number of distinguishable factor levels based on the factor score estimates.
- Expected Percentage of True Differences (EPTD): Reflects the proportion of observed differences in factor scores that align with true differences.

For individual assessment purposes, the following thresholds were applied (Ferrando & Lorenzo-Seva, 2018):

- FDI > 0.90: Indicates sufficient reliability of factor scores for individual-level assessment.
- Marginal reliabilities > 0.80: Reflect acceptable reliability for group-level comparisons.
- SR > 2: Demonstrates adequate differentiation among factor levels.
- EPTD > 90%: Confirms a high proportion of accurately represented true differences.

Additionally, the H-latent coefficient was calculated to evaluate the extent to which items reflected a common factor. The H-latent measures how well the factor can be identified by the continuous latent response variables underlying the observed item scores (Hancock & Mueller, 2001).

- H-latent > 0.80: Suggests a well-defined latent variable likely to remain stable across studies.
- H-latent < 0.80: Indicates a poorly defined latent variable prone to variability across studies.

- Rasch Analysis: The assumption of local independence among items was tested using Yen's Q3 test. Parameter estimation was performed using the Joint Maximum Likelihood Estimation (JMLE) method within the framework of Andrich's Rating Scale Model.

  Item and Person Fit Statistics: Fit was assessed for both items and persons using the following metrics: Outfit (Unweighted Mean Square Fit Statistic - UMS): Evaluates unexpected responses without weighting for the distance from the expected score and Infit (Weighted Mean Square Fit Statistic - WMS): Weights responses based on their proximity to the expected score. Both, UMS and WMS, are interpreted as 0.8–1.2 indicative of good fit and 0.5–1.5 reflecting acceptable fit (Linacre, 2023). Standardized Values for UMS and WMS (Std. UMS and Std. WMS): Standardized fit statistics to assess the degree of unexpectedness. With the according interpretation of Values >3

indicative of highly unexpected data and Values between -1.9 and 1.9 indicative of reasonably expected data (Linacre, 2002).

Quality Statistics: Quality indices were calculated for both items and persons: Separation Index: Represents the ability to distinguish between different levels of the latent trait. A Separation index >2 reflects adequate differentiation between individuals based on their latent trait levels. Reliability Index: Measures the consistency of the scale. Person Reliability > 0.8 indicates desirable reliability.

- Reliability: Internal consistency was assessed using omega and alpha coefficients, with 95% confidence intervals calculated for both.

- Finally, a known-groups validation was performed using bivariate inferential analysis to compare the models obtained for the scale. The following steps were conducted:

    1. Normality Assessment: The symmetry of the data distribution was evaluated using the Shapiro-Wilk test.

    2. Group Comparisons: For comparisons between two groups, the Mann-Whitney U test (a non-parametric test) was used. For comparisons among more than two groups, the Kruskal-Wallis test was applied, followed by a post hoc test using the Dwass-Steel-Critchlow-Fligne procedure to identify the specific groups with significant differences. A significance level of $\alpha \leq 0.05$ was set for all analyses.

    3. Effect Size Calculation: The Hedges' g statistic was used to calculate the effect size for the differences observed. Kelley's epsilon-squared (ε^2) provided a measure of the proportion of variance explained by the grouping variable.

- Software: Descriptive and inferential analyses were conducted using JAMOVI© v2.3.24. CFA and reliability assessments were performed with FACTOR© Release Version 12.02.01x64 bits, and Rasch analysis was conducted using J Metrik© software.

Ethics Considerations

Participants were informed of the study's purpose at the beginning of the online survey. Consent was implied upon survey completion. Participation was voluntary and anonymous. The study received ethical approval from the HUGC Dr. Negrín Research Ethics Committee (registration number 2022-271-1).

Results

Stage 1

Translation Procedure

The translators reported a low level of complexity in the language used. The terms *"physician"* and *"doctor"* were unified across all items, using *"médico"* in Spanish. The term *"nurses"* was preferred over *"personal de enfermería (spanish)"*. Following this process, the second version of the scale, v2 JSAPNC-e, was obtained.

Face Validity

The target population consisted of 28 participants, including 16 nurses and 12 physicians from primary care teams at a health center in Gran Canaria (Spain). The participants had a mean age of 48.7 years (SD: 12.0; Min: 28, Max: 65). Six participants were male (21.4%), and 22 were female (78.6%).

No participants identified items with comprehension issues, so no modifications were necessary. Thirteen participants (46.4%) reported taking 5–10 minutes to complete the questionnaire, while another 13 (46.4%) completed it in less than 5 minutes. Only two participants (7.2%) took longer than 10 minutes. Table 1 presents the scores assigned to the importance and utility of the instrument according to participants' professions. The item with the lowest acceptance was item 8: *"Doctors should be the dominant authority in all health care matters."*

The INFLESZ score of 47.87 indicated a comprehension level classified as "somewhat difficult" for the scale. Consequently, the Spanish version of the JSAPNC (JSAPNC-e) was deemed suitable for validation in a cross-sectional study.

Stage 2

Descriptive analysis of the sample and JSAPNC-e items.

The sample consisted of 205 participants (n=205), 150 women (73.2%) and 55 men (26.8%), with a mean age of 47.3 years (SD=10.2) (Minimum age: 23, Maximum age: 67), of whom 132 were nurses (64.4%) and 73 were physicians (35.6%). Regarding healthcare management areas, 116 participants belonged to the Gran Canaria Management Area (56.6%), 71 to Lanzarote (34.6%), and 18 to Tenerife (8.8%). In terms of academic level, 72.2% (n=148) of participants held a bachelor's degree, 22.0% (n=45) had completed a master's degree, and 5.9% (n=12) held a doctorate.

The average professional experience was 22.0 years (SD=10.1) (Minimum: 1, Maximum: 43), with an average of 14.0 years (SD=10.4) (Minimum: 1, Maximum: 38) of specific experience in primary care.

A total of 64.4% of the sample (n=132) had a specialization. Regarding nursing specializations, 47 participants were specialists in Family and Community Nursing (35.3%), 17 were specialists in Pediatric Nursing (12.8%), and 7 had other nursing specializations (5.3%). Among physicians, 53 participants were specialists in Family and Community Medicine (39.8%), 4 were Pediatricians (3.0%), and 5 had other medical specializations (3.8%).

The descriptive analysis of the JSAPNC-e items, including skewness and kurtosis values, can be found in Table 2.

Construct Validity through Confirmatory Factor Analysis for the JSAPNC-e

A confirmatory factor analysis (CFA) was conducted based on the initial four-dimensional model proposed for the JSAPNC. The KMO value and Bartlett's test indicated sufficient sampling adequacy (KMO=0.786 [95% CI: 0.666–0.807]; Bartlett's test: $p \leq 0.001$). The fit indices for this model were RMSEA=0.053 [95% CI: 0.048–0.058], NNFI=0.947 [95% CI: 0.888–0.957], CFI=0.974 [95% CI: 0.945–0.979], GFI=0.989 [95% CI=0.977–0.922], and AGFI=0.977 [95% CI: 0.953–0.983], indicating acceptable model fit. The RMSR was 0.037 [95% CI: 0.031–0.040], well below the expected RMSR value of 0.070 according to Kelley's criterion for an acceptable model. Table 3 presents the factor loadings for the items and dimensions after rotation, as well as the ORION, FDI, SR, EPTD, and H-latent values for each factor.

In this model, item no. 1 exhibited insufficient loading (below 0.300), and four items (6, 7, 14, and 15) showed cross-loadings across more than one factor. Based on the obtained factor loadings, the CFA reassigned items 1, 3, 4, 10, 13, and 14 to different factors compared to the original model.

Parallel analysis suggested a one-dimensional model; however, the unidimensionality analysis was inconclusive (UniCo=0.893 [95% CI: 0.877–0.921], ECV=0.752 [95% CI: 0.728–0.787], MIREAL=0.211 [95% CI: 0.189–0.213]). The MIREAL index indicated the potential assumption of a unidimensional model.

Based on these findings, a new CFA was conducted for a one-dimensional model. However, the fit indices for this model were less favorable (RMSEA=0.085 [95% CI: 0.081–0.089], NNFI=0.867 [95% CI: 0.826–0.891], CFI=0.886 [95% CI: 0.851–0.907], GFI=0.931 [95% CI: 0.871–0.937], and AGFI=0.919 [95% CI: 0.850–0.927]).

Construct-Structural Validity through RASCH Analysis

Given that the factor analysis suggested the possibility of a unidimensional solution, a RASCH analysis was performed. The scale scores were recoded, converting item scores to a 0–3 range. Regarding the assumption of local independence (Yen's Q3 test), the correlation matrix showed most values below 0.2–0.3, confirming the validity of local independence for the items.

An initial analysis indicated that item no. 4 had unobserved categories and was removed from the matrix (Supplementary Material 1). The analysis was repeated without this item, yielding the infit-(WMS) and outfit-UMS values (Table 4). For outfit-UMS, two items (1 and 5) displayed poor fit, while items 2, 6, 7, 10, and 13 showed good fit, and the remaining items demonstrated acceptable fit. All items presented adequate infit-(WMS) values.

In terms of scale quality statistics, adequate reliability (0.921) and separation (3.430) values were obtained for the items. However, reliability (0.676) and the separation index (1.444) for persons did not meet the desired thresholds.

Reliability

The overall Omega and Cronbach's Alpha coefficients were 0.801 [95% CI: 0.734–0.823] and 0.779 [95% CI: 0.731–0.820], respectively. Reliability analysis indicated that removing item 1 would lead to an increase in the internal consistency of the scale (Supplementary Material 2).

Known-Groups Validation

The total mean score was 53.5 [95% CI: 52.9–54.2], with SD=4.78. For known-groups validation, the association between certain variables and the total scale score was analyzed. No statistically significant differences were found for gender (p=0.550), years of professional experience (p=0.745), having a specialization (p=0.611), type of specialization (p=0.690), or academic level (p=0.846).

Statistically significant differences were found for profession (p=<0.001; Effect size Hedge's g=0.702) and the country where professional studies were completed (p=≤0.001; Effect size $\mathcal{E}^2$=0.066). Means, standard deviations, p-values, and effect sizes for each group can be consulted in the Supplementary Material 3.

Discussion

The JSAPNC scale has been widely used to measure attitudes toward interprofessional collaboration between physicians and nurses. The scale, originally reported by Hojat et al. (1999), initially consisted of 20 items. These items were developed based on an extensive literature review exploring physician-nurse relationships, areas of interaction, decision-making, role expectations, authority, autonomy, and responsibilities in patient care and follow-up. Most subsequent studies have employed a 15-item version of the scale after psychometric analyses examined the construct validity and internal consistency of this shorter version (Hojat et al., 2003; Jones et al., 2013).

The results from various factor analyses conducted with this scale support its construct validity; however, there is disparity regarding its dimensionality and reported reliability values (Jones et al., 2013). While most studies identify four factors or dimensions similar to the original scale (Hojat et al., 1999; Hojat et al., 2003; Sterchi, 2007; Elsous et al., 2017; Malliarou, 2021), others have reported different structures. For example, Taylor et al. (2009) found the tool to be unidimensional, and Ward et al. (2008) identified three factors. Some studies have not clarified the number of dimensions (Yildirim et al., 2006; Freire et al., 2018).

Different approaches to factor analysis may have directly influenced the results regarding the scale's dimensional structure. In our analysis, the scale could be considered unidimensional, as parallel analysis recommended a single-dimensional model, although the unidimensionality analysis was inconclusive. However, the fit indices for this model were not as favorable as those obtained for the four-factor model.

Acknowledging potential unidimensionality, we conducted a RASCH analysis (Stolt et al., 2022). To our knowledge, this is the first study applying this approach to the JSAPNC scale. In this analysis, the unidimensional model fit was excellent, except for items 2 and 5, which also displayed issues in the factor analysis. Other studies have also reported low factor loadings for these items (Ward et al., 2008; Malliarou et al., 2021). A noteworthy aspect of the RASCH approach is its ability to provide person- and item-independent measurements, a property known as invariance of measurement, which ensures that measurements are not dependent on the specific items presented or the respondent population (Lord, 1980). While the quality statistics (reliability and separation) were adequate for the items, they were suboptimal for the respondents.

There is considerable variability in the reliability values reported in different studies using this scale. Although Hojat et al. reported adequate Cronbach's alpha coefficients (ranging from 0.74 to 0.86 depending on the dimension), some studies have reported lower values (e.g., 0.65 in Taylor et al., and a range of 0.57 to 0.77 in Ward et al.). It is important to note that Cronbach's alpha is highly sensitive to the number of items in a scale, and some JSAPNC dimensions contain very few items (e.g., "Physician Authority" comprises only two items in the original model). In this study, both Cronbach's alpha and the Omega coefficient were calculated, with the latter being considered a better reliability indicator (Deng & Chan, 2017). Notably, the Omega coefficient has not been reported in previous studies using the JSAPNC.

The face validity and known-groups validation of the JSAPNC-e suggest higher acceptance of the scale among nurses compared to physicians. No statistically significant differences were detected for other variables, except for the country where the respondent completed their professional training. While this is the first validation study of the JSAPNC in the Spanish context, a prior study used the JSAPNC to identify similarities and differences in empathy and interprofessional collaboration among Spanish and Latin-American physicians-in-training starting their postgraduate training (San-Martín et al., 2017). This study reported a Cronbach's alpha of 0.86 but did not perform a formal validation process for the scale. Therefore, the results of that research should be interpreted with caution. Similarly, in Peru, the JSAPNC has been used without a formal validation process or psychometric evaluation, aside from reporting a Cronbach's alpha of 0.91 (Berduzco-Torres et al., 2021). We emphasize the importance of conducting rigorous validation and psychometric evaluations of instruments to ensure the validity and reliability of research findings (Mokkink et al., 2010).

Limitations

This validation study was conducted with a specific population (physicians and nurses working in primary care). It is well-established that perceptions of interprofessional collaboration can be highly influenced by the care setting (Delak & Širok, 2022; Matthys et al., 2017). Although specialists from various fields were included, further research is needed to confirm the scale's applicability in other contexts (e.g., hospital settings and other medical and nursing specialties). Additionally, while the sample size was sufficient, it was not as large as desired, which may have affected the conducted factor analysis (Ferrando et al., 2022). This limitation was mitigated by using the RASCH approach, which is less sensitive to sample size (Stolt et al., 2022). Finally, the convenience sampling method may have favored the participation of professionals with a positive predisposition toward interprofessional collaboration.

Conclusion

Our findings indicate that the Spanish version of the JSAPNC-e is suitable for assessing attitudes toward interprofessional collaboration between Spanish physicians and nurses. While the scale can be considered unidimensional, it may also be used with the four-dimensional model, though the Spanish version involves differences in item allocation to dimensions. Further studies with the JSAPNC-e in other healthcare contexts are needed to enhance our understanding of interprofessional collaboration attitudes among Spanish physicians and nurses.

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Table 1. Scores for Face Validity

	Total (n=28) M(SD)	Nurses (n=16) M(SD)	Physicians (n=12) M(SD)
Ítem 1	3.68(0.82)	3.88(0.34)	3.42 (1.16)
Ítem 2	2.96(0.96)	3.13(0.96)	2.75 (0.96)
Ítem 3	3.61(0.83)	3.63(0.81)	3.58(0.90)
Ítem 4	3.14(1.11)	3.44(0.96)	2.75(1.22)
Ítem 5	3.36(1.06)	3.63(0.88)	3.00(1.21)
Ítem 6	3.36(0.78)	3.50(0.63)	3.17(0.94)
Item 7	2.89(1.07)	3.06(1.00)	2.67(1.15)
Item 8	2.61(1.26)	2.75(1.29)	2.42(1.24)
Item 9	3.54(0.88)	3.75(0.45)	3.25(1.22)
Item 10	2.79(1.40)	2.69(1.40)	2.92(1.44)
Item 11	3.36(0.87)	3.56(0.73)	3.08(1.00)
Item 12	3.39(0.79)	3.44(0.73)	3.33(0.89)
Item 13	3.68(0.67)	3.81(0.40)	3.50(0.90)
Item 14	3.64(0.73)	3.69(0.79)	3.58(0.67)
Item 15	3.61(0.87)	3.63(0.88)	3.58(0.90)

Mean (Standard Deviation).Scores measured on a 1 to 4 Likert scale, where 1 was 'Not at all useful or not important in assessing Physicians -nurse collaboration' and 4 was 'Very useful or very important in assessing Physicians -nurse collaboration'.

Table 2. Descriptive analysis for JSAPNC-e items.

	M [CI 95%]	SD	Skewness	Kurtosis	Floor Strongly Disagree* n(%)	Ceiling (upper) Strongly Agree* n(%)
Item 1	3.82 [3.72-3.93]	0.58	-3.81	14.42	6(2.9%)	183(89.3%)
Item 2	3.47 [3.35-3.60]	0.70	-1.22	1.10	3(1.5%)	118(57.6%)
Item 3	3.78 [3.68-3.87]	0.52	-2.70	8.33	2(1.0%)	167(81.5%)
Item 4	3.85 [3.77-3.93]	0.43	-3.70	17.32	2(1.0%)	178(86.8%)
Item 5	3.88 [3.80-3.95]	0.42	-4.37	22.47	2(1.0%)	185(90.2%)
Item 6	3.15 [3.00-3.29]	0.83	-0.75	0.00	9(4.4%)	78(38.0%)
Item 7	2.96 [2.82-3.11]	0.82	-0.64	0.13	13(6.3%)	51(24.9%)
Item 8**	3.27 [3.12-3.43]	0.88	-1.05	0.26	103(50.2%)	11(5.4%)
Item 9	3.50 [3.37-3.63]	0.72	-1.39	1.51	4(2.0%)	125(61.0%)
Item 10**	3.71 [3.61-3.82]	0.58	-2.34	6.29	156(76.1%)	3(1.5%)
Item 11	3.71 [3.62-3.81]	0.54	-2.11	5.41	2(1.0%)	153(74.6%)
Item 12	3.46 [3.33-3.58]	0.70	-1.26	1.41	4(2.0%)	115(56.1%)
Item 13	3.50 [3.38-3.62]	0.66	-1.19	1.05	2(1.0%)	120(58.5%)
Item 14	3.69 [3.59-3.79]	0.56	-1.96	4.51	2(1.0%)	149(72.7%)
Item 15	3.76 [3.67-3.85]	0.52	-2.54	7.65	2(1.0%)	163(79.5%)

M [CI 95%]=Mean [confidence interval 95%]
SD= Standard Deviation
* Only the highest (ceiling) and lowest scores (floor) per item are shown.
** To score the scale, items 8 and 10 are reverse scored items (Strongly agree=1... Strongly disagree=4).

Table 3. Factor loadings and quality statistics for 4-dimension CFA model.

	Factor1 Physician's dominance	Factor 2 Nurses' Autonomy	Factor 3 Shared education and teamwork	Factor 4 Caring as opposed to curing
1 A nurse should be viewed as a collaborator and colleague with a physician rather than his/her assistant		**0.293 [-0.147-0.724]**		
2- Nurses are qualified to assess and respond to psychological aspects of patients' needs				**0.646 [0.412-0.798]**
3- During their education, medical and nursing students should be involved in teamwork in order to understand their respective roles		**0.328 [-0.023-0.690]**		
4- Nurses should be involved in making policy decisions affecting their working conditions		**0.793 [0.509-0.995)**		
5- Nurses should be accountable to patients for the nursing care they provide		**0.424 [-0.116-0.738]**		
6, There are many overlapping areas of responsibility between physicians and nurse			**0.462 [0.253-0.689]**	0.436[0.259-0.566]
7- Nurses have special expertise in patient education and psychological counseling			0.379 [0.195-0.548]	**0.708[0.523-0.923]**
8- Doctors should be the dominant authority in all health care matters	**0.314 [-0.069-0.585]**			
9- Physicians and nurses should contribute to decisions regarding the hospital discharge of patients			**0.368 [0.109-0.567]**	
10- The primary function of the nurse is to carry out the physician's orders		**0.501 [0.292-0.745]**		
11- Nurses should be involved in making policy decisions concerning the hospital support services upon which their work depends		**0.529[0.204-0.745]**		
12- Nurses should also have responsibility for monitoring the effects of medical treatment			**1.160[0.793-1.388]**	
13- Nurses should clarify a physician's order when they feel that it might have the potential for detrimental effects on the patient			**0.761[0.431-1.139]**	
14- Physicians should be educated to establish collaborative relationships with nurses	**0.516 [0.251-0.864]**		0.446[0.230-0.799]	

15- Interprofessional relationships between physicians and nurses should be included in their educational programs	0.436 [0.139-0.727]		**0.545[0.342-0.892]**	
Factor Determinacy Index (FDI)*	0.816	0.903	0.920	0.833
EAP scores reliability*	0.665	0.815	0.846	0.693
Sensitivity ratio (SR)*	1.410	2.101	2.340	1.504
Expected percentage of true differences (EPTD)*	85.2%	89.2%	90.2%	85.8%
H latent**	0.663[0.511-0.777]	0.817 [0.696 -0.888]	0.845 [0.765-0.940]	0.694[0.601-0.724]

*If factor scores are to be used for individual assessment, FDI values above .90, marginal reliabilities above .80, SR above 2, and EPTDs above 90% are recommended.
**High H values (>.80) suggest a well-defined latent variable which is more likely to be stable across studies

Table 4. RASCH analysis. Difficulty index and fit indices.

	Difficulty Index	Infit-WMS**(Std. WMS***)	Outfit-UMS**(Std.UMS***)
1 A nurse should be viewed as a collaborator and colleague with a physician rather than his/her assistant	-0.13	1.28(1.16)	2.48(2.47)
2- Nurses are qualified to assess and respond to psychological aspects of patients' needs	0.01	**0.97(-0.26)**	**0.90(-0.76)**
3- During their education, medical and nursing students should be involved in teamwork in order to understand their respective roles	-0.43	0.79(-1.17)	0.67(-1.36)
5- Nurses should be accountable to patients for the nursing care they provide	-0.54	**0.94(-0.12)**	1.56(1.34)
6, There are many overlapping areas of responsibility between physicians and nurse	0.70	**1.18(1.63)**	**1.20(1.80)**
7- Nurses have special expertise in patient education and psychological counseling	1.10	**1.06(0.60)**	**1.05(0.53)**
8- Doctors should be the dominant authority in all health care matters	0.59	**1.17(1.52)**	1.23(1.70)
9- Physicians and nurses should contribute to decisions regarding the hospital discharge of patients	0.07	**0.80(-1.72)**	0.75(-1.81)
10- The primary function of the nurse is to carry out the physician's orders	-0.24	**0.99(-0.03)**	**1.02(0.17)**
11- Nurses should be involved in making policy decisions concerning the hospital support services upon which their work depends	-0.36	**0.82(-1.13)**	0.68(-1.80)
12- Nurses should also have responsibility for monitoring the effects of medical treatment	0.12	**1.19(1.56)**	1.31(2.15)
13- Nurses should clarify a physician's order when they feel that it might have the potential for detrimental effects on the patient	-0.14	**1.04(0.39)**	**1.10(0.76)**
14- Physicians should be educated to establish collaborative relationships with nurses	-0.34	**0.84(-1.04)**	0.68(-1.94)
15- Interprofessional relationships between physicians and nurses should be included in their educational programs	-0.41	0.77(-1.34)	0.78(-0.95)

** Unweighted Mean Square fit statistic (UMS)- and infit - Weighted Mean Square Fit Statistic (WMS): Values of fit indices between 0.8 and 1.2 meant a good fit and values between 0.5 and 1.5 meant an acceptable fit (productive for the measurement). Values > 2.0 Distorts or degrades the measurement system

***Standardized Value Unweighted Mean Square fit statistic (UMS) and Standardized Value infit - Weighted Mean Square Fit Statistic (WMS): values ≥ 3 indicate Data very unexpected if they fit the model (perfectly), so they probably do not/ values 2.0 - 2.9 indicate Data noticeably unpredictable./values -1.9 - 1.9 Data have reasonable predictability/values ≤ -2 Data are too predictable. Other "dimensions" may be constraining the response patterns

Supplementary Material 1 Initial RASCH analysis

RASCH ANALYSIS
jefferson1.JEFFERSONPRUEBA
marzo 28, 2024 11:07:50

FINAL JMLE ITEM STATISTICS

Item	Difficulty	Std. Error	WMS	Std. WMS	UMS	Std. UMS
v1	-0,14	0,14	1,30	1,23	2,55	2,54
v2	0,01	0,12	0,97	-0,23	0,90	-0,72
v3	-0,46	0,15	0,82	-0,95	0,70	-1,20
v4			DROPPED			
v5	-0,58	0,18	1,00	0,10	1,65	1,49
v6	0,76	0,11	1,16	1,52	1,18	1,66
v7	1,19	0,11	1,04	0,38	1,03	0,29
v8	0,64	0,10	1,15	1,41	1,21	1,56
v9	0,08	0,12	0,80	-1,72	0,75	-1,79
v10	-0,25	0,14	1,01	0,09	1,05	0,29
v11	-0,39	0,14	0,84	-0,96	0,70	-1,65
v12	0,13	0,12	1,20	1,57	1,31	2,16
v13	-0,15	0,12	1,05	0,47	1,11	0,85
v14	-0,36	0,14	0,86	-0,87	0,69	-1,80
v15	-0,45	0,15	0,80	-1,12	0,81	-0,77

Item dropped due to unobserved categories. Collapse categories to retain item.

Fiability

Estadísticas de Fiabilidad de Escala

	Alfa de Cronbach	ω de McDonald
escala	0.779	0.801

Estadísticas de Fiabilidad de Elemento

	Si se descarta el elemento	
	Alfa de Cronbach	**ω de McDonald**
item_1	0.784	0.805
item_2	0.762	0.790
item_3	0.761	0.783
item_4	0.761	0.779
item_5	0.772	0.794
item_6	0.776	0.798
item_7	0.766	0.793
item_8	0.771	0.791
item_9	0.748	0.775
item_10	0.768	0.790
item_11	0.757	0.778
item_12	0.779	0.801
item_13	0.771	0.796
item_14	0.760	0.783
item_15	0.759	0.781

Supplementary Material 3. Means, standard deviations, p-values, and effect sizes for each group.

	M(SD)[1]	
Profession		
Nurses n=132	54.7(3.77)	
Physicians n=73	51.5 (5.67)	
p-value[2]	**<0.001***	
Effect size (Hedges's g)	0.702	
Gender		
Female n=150	53.5 (4.42)	
Male n=55	53.5 (5.70)	
p-value[2]	0.550	
Effect size[3] (Hedges's g)	0.000	
Having a specialization		
Yes n=296	53.4 (4.84)	
No n=19	53.7 (4.39)	
p-value[2]	0.611	
Effect size[3] (Hedges's g)	0.062	
Years of professional experience		
0 to 22 years of professional experience n=95	53.2 (5.17)	
More than 22 years of professional experience n=109	53.8 (4.38)	
p-value[2]	0.745	
Effect size[3] (Hedges's g)	0.125	

1 Mean (Standard Deviation)
2 Mann-Whitney's U-test; *statistically significant value
3 Effect size according to Hedges (Hedges' g): it considers both groups' variances and sizes, Values <0.2 indicate small effects, 0.5 indicates medium effect and 0.8, large effect

M(SD)	M(SD)	M(SD)	X^2	Kruskall Wallis test p-value	Effect Size ε^2	Dwass-Steel-Critchlow-Fligne Post Hoc
Spain (a) (n=184)	**Other European Union country (b) (n=2)**	**Another country outside the European Union (c) (n=19)**				
54.0(4.49)	48.5(6.36)	49.6(5.54)	13.5	≤0.001*	0.066	a,c (p=0.002)**
Grade (n=148)	**Master's degree (n=45)**	**Doctorate (n=12)**				
53.6(4.71)	53.2(4.74)	53.3(6.11)	0.33	0.846	0.001	No difference
Family and Community Specialty (1) (a) (n=100)	**Paediatrics (2)(b) (n=21)**	**Other specialities (c) (n=12)**				
53.5(4.68)	53.1(4.63)	53.8(6.11)	0.74	0.690	0.005	No difference

Mean (Standard Deviation)
(1) Both physicians and nurses specialising in family and community specialty were analysed together.
(2) Both physicians and nurses specialising in paediatrics were analysed together.
X^2=Chi squared. ε^2= Epsilon squared. Effect size from 0 to 1, with 1 being the maximum effect.
*Statistically significant results according to the Kruskall Wallis test. **P-value of the two-to-two contrast.