



Original Article

Cross-cultural adaptation and validation of the advanced practice nursing assessment instrument for the Portuguese context: A methodological study

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ABSTRACT

**Background & Aim:** Advanced Practice Nursing plays a crucial role in improving healthcare access, quality, and efficiency, being increasingly recognized in Portugal as a growing professional field. However, no validated instrument exists in Portugal to rigorously assess advanced practice nursing competencies. The Advanced Practice Nursing Competency Assessment Instrument, originally developed and validated in Spain, represents a robust tool for this purpose. This study aimed to cross-culturally adapt and validate the Advanced Practice Nursing Competency Assessment Instrument for the Portuguese context.

**Methods & Materials:** This methodological study was conducted in two phases. Cross-cultural adaptation followed established stages: two independent forward translations, synthesis, two back-translations, expert committee review, pre-test, and feedback to the original author. Psychometric evaluation used a cross-sectional sample of nurses from a local health unit in Northern Portugal. Analyses included descriptive statistics, exploratory factor analysis through principal component analysis, and internal consistency calculated by Cronbach's alpha, item-total, and inter-item correlations.

**Results:** Expert consensus was achieved during the review process. The pre-test with a sample size of thirty-five nurses confirmed instrument clarity and usability. The validation sample included two hundred and sixty-four nurses and specialist nurses. Seven factors explained sixty-six percent of the total variance, representing a reduction from the original eight-factor structure. Two dimensions, Quality Management and Care Management, converged into a single factor in the Portuguese version. The scale demonstrated excellent reliability, with a total Cronbach's alpha of 0.960, factor alphas ranging from 0.821 to 0.916, and adequate corrected item-total correlations.

**Conclusion:** The Portuguese version demonstrates adequate content validity, a coherent factor structure, and excellent reliability, supporting its use to assess advanced practice nursing competencies in the Portuguese health system.

Introduction

Advanced Practice Nursing (APN) is defined by the International Council of Nurses (ICN) as a field of nursing that expands the scope of professional practice by integrating theoretical and evidence-based knowledge acquired through advanced education, typically at the master's level (1,2). This practice encompasses specialized functions, clinical autonomy, and leadership in highly complex contexts and is internationally recognized

through roles such as Clinical Nurse Specialist (CNS) and Nurse Practitioner (NP) (2,3).

In Portugal, APN has been gaining relevance, following international trends and responding to emerging healthcare needs (4,5). The Portuguese Nursing and Midwifery Council (Ordem dos Enfermeiros) has established criteria and competencies for specialized practice, requiring advanced training to obtain the title of specialist nurse,



which includes clinical, scientific, and human competencies for the provision of differentiated care (6). Despite this progress, the development of advanced roles in Portuguese nursing still faces challenges, particularly when compared to countries such as the United Kingdom, where APN is widely regulated and recognized (3,7).

The relevance of implementing APN in Portugal is reinforced by the need to ensure the financial sustainability of the healthcare system, improve accessibility, and increase patient and professional satisfaction (5). International evidence shows that APN contributes to better clinical outcomes, higher quality of care, and greater efficiency in resource utilization, particularly in critical care and emergency settings (8,9). Therefore, the expansion of these roles within the Portuguese context represents a strategic opportunity to address current healthcare challenges.

Despite the growing recognition of APNs in Portugal, no validated instrument currently exists to rigorously assess nurses' competencies in this field. Structured assessment of APN competencies is, however, essential to support the development of this level of practice. In this regard, the contribution of Sastre-Fullana et al. (10) is noteworthy, as they developed and validated in Spain a specific instrument for assessing advanced practice nursing competencies.

The choice of the instrument developed by Sastre-Fullana et al. (10) is supported by the methodological rigor that characterized its construction and validation. The study began with a comprehensive review of the international literature, including both scientific publications and grey literature from regulatory bodies, which enabled the identification of cross-cutting domains of competencies relevant to APN. Subsequently, expert consensus was achieved using the Delphi technique, ensuring content validity and alignment with the European context. The instrument was also subjected to rigorous psychometric analyses, including exploratory and confirmatory factor analyses, which demonstrated high internal consistency and structural validity. In addition to its solid evidence base and international references, the cultural and organizational

similarities between the Spanish context, where it was developed, and the Portuguese context reinforce its relevance and applicability to the assessment of APN competencies. Other available instruments are limited to specific settings, such as those developed in Scandinavian or Japanese contexts, which restrict their transferability due to cultural, structural, and organizational differences in nursing practice (11,12).

The central construct under study was advanced practice nursing competencies, as operationalized by the APNCAI conceptual framework, which organizes these competencies into eight theoretically grounded dimensions. The absence of a validated instrument aligned with this framework in Portugal limits structured assessment, research comparability, and evidence-based professional development, thereby justifying the present cross-cultural adaptation and validation study. Therefore, the cross-cultural adaptation and validation of the Advanced Practice Nursing Competency Assessment Instrument (APNCAI), originally developed and validated in Spain, is justified as a robust tool for assessing APN competencies (10).

## **Methods**

A methodological and cross-sectional study was conducted, focusing on the translation, cross-cultural adaptation, and validation of the APNCAI for the Portuguese context, following COSMIN recommendations for the evaluation of psychometric properties of measurement instruments (13), and the adaptation process included assessment of content validity, comprehensibility, construct validity, and reliability.

The instrument was originally developed in Spain to assess the competencies of advanced practice nurses, based on regulatory frameworks from countries such as Canada, the United States, the United Kingdom, and Australia (10). It contains 44 items distributed across eight dimensions: Research and Evidence-Based Practice (8 items), Clinical and Professional Leadership (4 items), Professional Autonomy (8 items), Interprofessional Relationships and Mentorship (6 items), Quality Management (4 items), Care

Management (6 items), Teaching and Professional Education (4 items), and Health Promotion (4 items) (10). The items are rated on a five-point Likert scale (1= Never to 5=Always). The global score of the instrument ranges from 44 to 220 points, obtained by summing the responses across all items, with higher scores indicative of higher levels of advanced practice nursing competencies.

The process followed the methodology proposed by Beaton et al.(14), widely applied in similar studies (15). Six steps were carried out: (i) initial translation (T1 and T2) by two independent translators, one without prior knowledge of the instrument and another with clinical experience; (ii) synthesis of translations (T12); (iii) back-translation (BT1 and BT2) by two native Spanish speakers without prior contact with the original instrument; (iv) review by an expert committee composed of five professionals with clinical and academic experience, selected purposively based on academic degree and clinical experience related to the study, who assessed semantic, idiomatic, cultural, and conceptual equivalence, as well as clarity and relevance, using a four-point Likert scale (16,17). Based on this evaluation, the Content Validity Index (CVI) was calculated for each item to quantify the level of expert agreement (18). A cutoff value of  $\geq 0.80$  was considered acceptable. Items scoring below this threshold would be revised based on expert feedback; however, no items required removal, as all met the predefined criterion.

The constitution of this committee followed international recommendations, which suggest the inclusion of at least five experts in such processes (16). (v) An online pre-test was then conducted with a convenience sample of 35 nurses and specialist nurses, aiming to assess face validity, specifically the comprehensibility and clarity of the instrument, in accordance with COSMIN recommendations for evaluating measurement instruments. Participants rated the clarity of instructions, items, and response options using a 5-point Likert scale, allowing the assessment of understandability and usability prior to psychometric testing to confirm its adequacy without the need for substantial changes; and (vi) submission of the entire process to the author of the original

instrument, as recommended in the literature (17–19).

The study was conducted in two distinct phases. The first phase involved cross-cultural adaptation of the instrument, following Beaton et al. methodology (14). The second phase consisted of psychometric validation, in which the adapted instrument was administered to the target population.

Although the instrument has been previously described, its factorial structure has not been consistently replicated across independent cultural contexts. A Brazilian Portuguese version has been developed and evaluated using structural equation modelling (26,35); however, covariance-based confirmatory factor analysis with global model fit indices has not yet been conducted in European Portuguese samples. Considering the complexity of the original 8-factor, 44-item structure and the moderate sample size of the present study ( $n= 264$ ), an exploratory factor analysis (EFA) was conducted as an initial step to examine the dimensionality of the instrument in this context. This approach allows the empirical assessment of the latent structure and provides a foundation for subsequent confirmatory testing in larger and independent samples.

### ***Population and sample***

The target population included 1,443 nurses from a Local Health Unit (Unidade Local de Saúde, ULS) in Northern Portugal, representing the total number of eligible professionals at the time of the study. A ULS is an integrated healthcare organization that brings together, under a single management structure, primary care, hospital care, and community services. This model aims to ensure continuity of care, optimize the use of resources, and improve accessibility and quality across different levels of the healthcare system.

Conducting the study in this context, which encompasses various care settings and multiple professional profiles, strengthens the generalizability and applicability of the results obtained. All nurses were invited to participate through institutional email. Non-probabilistic convenience sampling was used. Considering the recommendation of five to ten participants

per item, a minimum sample size of 220 nurses was defined for the 44 items of the APNCAI(20). A total of 264 valid responses were obtained and included in the psychometric analysis. Eligible participants included professionals with at least six months of work experience, from different categories and contractual backgrounds.

### **Data collection**

Data were collected between November 2024 and April 2025 using an online questionnaire developed in Microsoft Forms®. The questionnaire comprised two sections: (i) sociodemographic, academic, and professional characterization; and (ii) the Portuguese version of the APNCAI. With the approval by the Ethics Committee and authorization from the Board of Directors, collaboration was requested from the Director of Nursing, who, together with the Nursing Managers of the Local Health Unit, facilitated the distribution of the questionnaire link through the institutional email system. Participation was voluntary, with informed consent included in the form.

### **Data analysis**

Categorical variables were described using absolute and relative frequencies, while quantitative variables were summarized using mean, standard deviation, median, and interquartile interval [IQI]. The validation of the internal structure of the scale was performed through exploratory factor analysis, using the Principal Component Analysis (PCA) method with varimax rotation. The Kaiser's criterion (eigenvalue > 1), scree plot, and explained variance > 5% were employed for the decision on the number of factors to retain. Sample adequacy was tested using the KMO index and Bartlett's test (21). Reliability was assessed through internal consistency (Cronbach's alpha, mean inter-item correlation, and corrected item-total correlation), considering acceptable values of  $\alpha \geq 0.70$ , inter-item correlations between 0.15 and 0.50, and item-total correlations between 0.30 and 0.70 (21-23). All analyses were conducted using the IBM SPSS Statistics software, version 26.0.

### **Ethical considerations**

The study was approved by the Ethics Committee of the Local Health Unit where it was conducted (approval no. 73/2024) and authorized by the Board of Directors on November 28, 2024. All participants received written information regarding the study objectives and methodology, with guarantees of anonymity, confidentiality, and the right to withdraw.

### **Results**

The initial translations (T1 and T2) revealed minor linguistic differences, primarily related to terminology and phrasing. These discrepancies were discussed and resolved during the synthesis phase (T12), resulting in a consensual version. The back-translations (BT1 and BT2), performed by translators blinded to the original instrument, showed strong semantic equivalence with the original Spanish version. No conceptual inconsistencies were identified, and no items required structural modification.

The expert committee consisted of five specialists, of whom 60% were male, with a mean age of 40.4 years (SD 3.05). All experts held a master's degree and specialist nurse credentials, with a mean professional experience of 18.2 years (SD 2.95). They analyzed semantic, idiomatic, cultural, and conceptual equivalences, as well as the clarity and relevance of the items, instructions, and response options. This evaluation was performed using a 4-point Likert scale, where 1 corresponded to Not equivalent, 2 to Requires major revision to be equivalent, 3 to Requires minor revision to be equivalent, and 4 to Equivalent. The items achieved high content validity, with most obtaining a CVI of 1.0, while items 1.4, 1.8, 2.4, 3.1, 4.2, 4.5, 4.6, and 6.3 scored 0.80. Consensus was reached on all items, and the few suggestions made focused mainly on grammatical and terminological adjustments to adapt the wording to the Portuguese nursing practice context, without altering their conceptual content.

Regarding the pre-test (n=35), participants evaluated the clarity and usability of the instrument using a 5-point Likert scale. The majority rated the instructions, items, and

response options as clear and easy to understand (scores  $\geq 4$ ), and no modifications were suggested. The questionnaire was therefore considered adequate in its pre-final version and applied to the validation sample.

### ***Validation of the Portuguese version of APNCAI***

The obtained sample (n=264) was predominantly female (81.8%), with a mean age of 40.6 (8.7) years. The mean professional experience was 17.6 (8.7) years, while the median [Q<sub>1</sub>; Q<sub>3</sub>] length of service in the current department was 7 years [4–15], ranging from 0 to 35 years. Participants worked in different departments, with higher representation in Emergency (29.5%), Medical (25.4%), and

Primary Health Care (20.1%), followed by Surgical (10.6%), Intermediate and Intensive Care (7.2%), and Women's and Children's Health (7.2%).

Regarding academic qualifications, 70.1% held a bachelor's degree and 29.9% a master's degree. Concerning professional category, 65.5% were staff nurses, 32.6% specialist nurses, and 1.9% nurse managers. Regarding professional title, 53.8% held the title of specialist nurse, while 46.2% were generalist nurses. The most frequent areas of specialization were Medical-Surgical Nursing (19.0%) and Critical Care Nursing (19.0%), alongside other less represented specialties. All results are presented in Table 1.

**Table 1.** Sociodemographic, professional, and academic characterization of the sample (n = 264)

| <b>Varibales</b>                                                                | <b>n(%)</b>       |
|---------------------------------------------------------------------------------|-------------------|
| <b>Gender</b>                                                                   |                   |
| Female                                                                          | 216 (81.8)        |
| Male                                                                            | 48 (18.2)         |
| <b>Age, M (SD), min-max</b>                                                     | 40.6 (8.7). 24-66 |
| <b>Years of professional experience, M (SD), min-max</b>                        | 17.6 (8.7). 1-42  |
| <b>Years in current department, Med [Q<sub>1</sub>; Q<sub>3</sub>], min-max</b> | 7 [4; 15]. 0-35   |
| <b>Department</b>                                                               |                   |
| Emergency                                                                       | 78 (29.5)         |
| Medical                                                                         | 67 (25.4)         |
| Primary health care                                                             | 53 (20.1)         |
| Surgical                                                                        | 28 (10.6)         |
| Intermediate and intensive care                                                 | 19 (7.2)          |
| Women's and children's health                                                   | 19 (7.2)          |
| <b>Academic qualifications</b>                                                  |                   |
| Bachelor's degree                                                               | 185 (70.1)        |
| Master's degree                                                                 | 79 (29.9)         |
| <b>Professional category</b>                                                    |                   |
| Generalist staff nurse                                                          | 173 (65.5)        |
| Specialist nurse                                                                | 86 (32.6)         |
| Nursing manager                                                                 | 5 (1.9)           |
| <b>Professional title</b>                                                       |                   |
| Specialist nurse                                                                | 142 (53.8)        |
| Generalist staff nurse                                                          | 122 (46.2)        |
| <b>Nursing specialization area</b>                                              |                   |
| Medical-surgical nursing                                                        | 27 (19.0)         |
| Critical care nursing                                                           | 27 (19.0)         |
| Rehabilitation nursing                                                          | 26 (18.3)         |
| Community nursing                                                               | 18 (12.7)         |
| Child and pediatric health nursing                                              | 16 (11.3)         |
| Maternal and obstetric health nursing                                           | 7 (4.9)           |
| Community and public health nursing                                             | 6 (4.2)           |
| Perioperative nursing                                                           | 5 (3.5)           |
| Mental health and psychiatric nursing                                           | 4 (2.8)           |
| Palliative care nursing                                                         | 3 (2.1)           |
| Family health nursing                                                           | 2 (1.4)           |
| Chronic care nursing                                                            | 1 (0.7)           |

Note: Absolute frequency; %: Relative frequency; M: Mean; SD: Standard deviation; Med: Median; Q<sub>1</sub>: First quartile; Q<sub>3</sub>: Third quartile. Source: Authors.

### Descriptive statistics by subscale

Regarding the mean scores obtained in each subscale, the highest values were observed in *Teaching and Professional Education*, with a mean of 4.1 (0.7), followed by *Interprofessional Relationships and Mentorship*, with 3.7 (0.7). *Care Management* showed a mean of 3.6 (0.7), while *Professional Autonomy* obtained 3.5 (0.8). *Quality Management* recorded a mean of 3.4 (0.8), and *Health Promotion* 3.3 (1.0). The lowest mean scores were found in *Research and Evidence-Based Practice*, with 3.1 (0.8), and *Clinical and Professional Leadership*, with 2.6 (0.9).

### Internal structure (Principal Component Analysis/ Varimax)

The adequacy of the sample for factor analysis was considered excellent, with a KMO value of 0.934 and a statistically significant Bartlett's test of sphericity ( $p < 0.001$ ). Based on Kaiser's criterion, seven factors were extracted, accounting for 66% of the total variance. Of these, only the first three factors individually explained more than 5% of the variance, while

the remaining factors contributed smaller proportions but still met the eigenvalue greater than one threshold. After varimax rotation, the structure proved coherent, with all items showing adequate factor loadings ( $\geq 0.40$ ) and being consistently distributed across the seven identified factors. The scree plot also supported the retention of seven factors. The detailed composition of the factors and their respective loadings is presented in Table 2.

### Reliability by internal consistency

The analysis of the instrument, with its 44 items, showed a Cronbach's alpha of 0.960, indicating excellent internal consistency. The factor-level analysis also revealed high values, ranging from 0.821 to 0.916, reinforcing the robustness of the instrument. Corrected item-total correlations were generally above 0.40, confirming the adequacy of all items, while inter-item correlations remained within recommended values across all dimensions. Table 3 details the Cronbach's alpha values, corrected item-total correlations, and mean inter-item correlations for each factor.

**Table 2.** Composition of the seven factors of APNCAI, with the factor loadings of each item obtained by PCA (n = 264)

|                 | Factor 1     | Factor 2 | Factor 3     | Factor 4 | Factor 5 | Factor 6     | Factor 7     |
|-----------------|--------------|----------|--------------|----------|----------|--------------|--------------|
| <b>Factor 1</b> |              |          |              |          |          |              |              |
| Item 1 (Q1.1)   | 0.653        |          |              |          |          |              |              |
| Item 2 (Q1.2)   | 0.675        |          |              |          |          |              |              |
| Item 3 (Q1.3)   | 0.732        |          |              |          |          |              |              |
| Item 4 (Q1.4)   | 0.708        |          |              |          |          |              |              |
| Item 5 (Q1.5)   | 0.750        |          |              |          |          |              |              |
| Item 6 (Q1.6)   | 0.708        |          |              |          |          |              |              |
| Item 7 (Q1.7)   | 0.690        |          |              |          |          |              |              |
| Item 8 (Q1.8)   | 0.660        |          |              |          |          |              |              |
| <b>Factor 6</b> |              |          |              |          |          |              |              |
| Item 9 (Q2.1)   |              |          |              |          |          | 0.543        |              |
| Item 10 (Q2.2)  | <b>0.616</b> |          |              |          |          | <b>0.432</b> |              |
| Item 11 (Q2.3)  |              |          |              |          |          | 0.723        |              |
| Item 12 (Q2.4)  |              |          |              |          |          | 0.684        |              |
| <b>Factor 2</b> |              |          |              |          |          |              |              |
| Item 13 (Q3.1)  |              | 0.669    |              |          |          |              |              |
| Item 14 (Q3.2)  |              | 0.648    |              |          |          |              |              |
| Item 15 (Q3.3)  |              | 0.654    |              |          |          |              |              |
| Item 16 (Q3.4)  |              | 0.768    |              |          |          |              |              |
| Item 17 (Q3.5)  |              | 0.737    |              |          |          |              |              |
| Item 18 (Q3.6)  |              | 0.716    |              |          |          |              |              |
| Item 19 (Q3.7)  |              | 0.551    |              |          |          |              |              |
| Item 20 (Q3.8)  |              | 0.486    |              |          |          |              |              |
| <b>Factor 7</b> |              |          |              |          |          |              |              |
| Item 21 (Q4.1)  |              |          |              |          |          |              | 0.783        |
| Item 22 (Q4.2)  |              |          |              |          |          |              | 0.778        |
| Item 23 (Q4.3)  |              |          |              |          |          |              | 0.547        |
| Item 24 (Q4.4)  |              |          |              |          |          |              | 0.487        |
| Item 25 (Q4.5)  |              |          |              |          |          |              | 0.536        |
| Item 26 (Q4.6)  |              |          | <b>0.406</b> |          |          |              | <b>0.309</b> |

|                 | Factor 1 | Factor 2 | Factor 3     | Factor 4 | Factor 5 | Factor 6 | Factor 7 |
|-----------------|----------|----------|--------------|----------|----------|----------|----------|
| <b>Factor 3</b> |          |          |              |          |          |          |          |
| Item 27 (Q5.1)  |          |          | 0.443        |          |          |          |          |
| Item 28 (Q5.2)  |          |          | 0.454        |          |          |          |          |
| Item 29 (Q5.3)  |          |          | 0.489        |          |          |          |          |
| Item 30 (Q5.4)  |          |          | 0.549        |          |          |          |          |
| <b>Factor 3</b> |          |          |              |          |          |          |          |
| Item 31 (Q6.1)  |          |          | <b>0.635</b> |          |          |          |          |
| Item 32 (Q6.2)  |          |          | <b>0.668</b> |          |          |          |          |
| Item 33 (Q6.3)  |          |          | <b>0.673</b> |          |          |          |          |
| Item 34 (Q6.4)  |          |          | <b>0.639</b> |          |          |          |          |
| Item 35 (Q6.5)  |          |          | <b>0.611</b> |          |          |          |          |
| Item 36 (Q6.6)  |          |          | <b>0.536</b> |          |          |          |          |
| <b>Factor 5</b> |          |          |              |          |          |          |          |
| Item 37(Q7.1)   |          |          |              |          | 0.768    |          |          |
| Item 38 (Q7.2)  |          |          |              |          | 0.747    |          |          |
| Item 39 (Q7.3)  |          |          |              |          | 0.741    |          |          |
| Item 40 (Q7.4)  |          |          |              |          | 0.737    |          |          |
| <b>Factor 4</b> |          |          |              |          |          |          |          |
| Item 41(Q8.1)   |          |          |              | 0.757    |          |          |          |
| Item 42 (Q8.2)  |          |          |              | 0.848    |          |          |          |
| Item 43 (Q8.3)  |          |          |              | 0.823    |          |          |          |
| Item 44 (Q8.4)  |          |          |              | 0.718    |          |          |          |

Note: Source: Authors.

Table 3. Reliability analysis by factor

|                 | Cronbach's Alpha | Corrected item-total correlation | Mean inter-item correlation |
|-----------------|------------------|----------------------------------|-----------------------------|
| <b>Factor 1</b> | 0.910            |                                  | 0.532                       |
| Item 1 (Q1.1)   | 0.905            | 0.618                            |                             |
| Item 2 (Q1.2)   | 0.902            | 0.652                            |                             |
| Item 3 (Q1.3)   | 0.899            | 0.701                            |                             |
| Item 4 (Q1.4)   | 0.896            | 0.737                            |                             |
| Item 5 (Q1.5)   | 0.898            | 0.727                            |                             |
| Item 6 (Q1.6)   | 0.902            | 0.659                            |                             |
| Item 7 (Q1.7)   | 0.899            | 0.705                            |                             |
| Item 8 (Q1.8)   | 0.896            | 0.744                            |                             |
| Item 10 (Q2.2)  | 0.900            | 0.691                            |                             |
| <b>Factor 2</b> | 0.890            |                                  | 0.526                       |
| Item 13 (Q3.1)  | 0.876            | 0.671                            |                             |
| Item 14 (Q3.2)  | 0.871            | 0.733                            |                             |
| Item 15 (Q3.3)  | 0.877            | 0.665                            |                             |
| Item 16 (Q3.4)  | 0.867            | 0.783                            |                             |
| Item 17 (Q3.5)  | 0.871            | 0.729                            |                             |
| Item 18 (Q3.6)  | 0.878            | 0.654                            |                             |
| Item 19 (Q3.7)  | 0.882            | 0.608                            |                             |
| Item 20 (Q3.8)  | 0.890            | 0.592                            |                             |
| <b>Factor 3</b> | 0.916            |                                  | 0.506                       |
| Item 26 (Q4.6)  | 0.912            | 0.610                            |                             |
| Item 27 (Q5.1)  | 0.907            | 0.702                            |                             |
| Item 28 (Q5.2)  | 0.907            | 0.691                            |                             |
| Item 29 (Q5.3)  | 0.906            | 0.708                            |                             |
| Item 30 (Q5.4)  | 0.907            | 0.702                            |                             |
| Item 31 (Q6.1)  | 0.911            | 0.621                            |                             |
| Item 32 (Q6.2)  | 0.908            | 0.675                            |                             |
| Item 33 (Q6.3)  | 0.906            | 0.717                            |                             |
| Item 34 (Q6.4)  | 0.906            | 0.720                            |                             |
| Item 35 (Q6.5)  | 0.907            | 0.693                            |                             |
| Item 36 (Q6.6)  | 0.910            | 0.620                            |                             |
| <b>Factor 4</b> | 0.913            |                                  | 0.723                       |
| Item 41(Q8.1)   | 0.891            | 0.790                            |                             |
| Item 42 (Q8.2)  | 0.866            | 0.860                            |                             |
| Item 43 (Q8.3)  | 0.876            | 0.831                            |                             |
| Item 44 (Q8.4)  | 0.911            | 0.728                            |                             |
| <b>Factor 5</b> | 0.851            |                                  | 0.590                       |
| Item 37(Q7.1)   | 0.837            | 0.630                            |                             |
| Item 38 (Q7.2)  | 0.784            | 0.754                            |                             |
| Item 39 (Q7.3)  | 0.793            | 0.736                            |                             |

|                 | Cronbach's Alpha | Corrected item-total correlation | Mean inter-item correlation |
|-----------------|------------------|----------------------------------|-----------------------------|
| Item 40 (Q7.4)  | 0.826            | 0.655                            |                             |
| <b>Factor 6</b> | 0.824            |                                  | 0.607                       |
| Item 9 (Q2.1)   | 0.928            | 0.495                            |                             |
| Item 11 (Q2.3)  | 0.646            | 0.784                            |                             |
| Item 12 (Q2.4)  | 0.646            | 0.787                            |                             |
| <b>Factor 7</b> | 0.821            |                                  | 0.494                       |
| Item 21(Q4.1)   | 0.791            | 0.596                            |                             |
| Item 22 (Q4.2)  | 0.759            | 0.728                            |                             |
| Item 23 (Q4.3)  | 0.784            | 0.624                            |                             |
| Item 24 (Q4.4)  | 0.785            | 0.619                            |                             |
| Item 25 (Q4.5)  | 0.814            | 0.552                            |                             |

Note: Source: Authors.

## Discussion

The cross-cultural adaptation of the Advanced Practice Nursing Competency Assessment Instrument to the Portuguese context proceeded without relevant difficulties in the stages of translation, synthesis, and back-translation, reinforcing the importance of qualified translators and clearly defined selection criteria, aspects widely emphasized in the literature on instrument adaptation (15,24,25,38). This step has been consistently recommended as a means to ensure conceptual and semantic equivalence between the original and the translated versions (14). In the present study, the methodological choice of two independent back-translations proved particularly useful, confirming the fidelity of the Portuguese version and ensuring greater robustness in communication with the original author of the instrument. This procedure aligns with the framework proposed by Beaton et al. (14) and has also been adopted in other APNCAI validations in different countries (27-29).

The expert committee represented another critical step in the process, playing a central role in the evaluation of semantic, idiomatic, cultural, and conceptual equivalence of the instrument. The selection of members followed internationally recognized criteria, such as a minimum academic degree of Master's and significant clinical experience, in accordance with classic validation recommendations (15,16). This diverse composition enabled a thorough and multidimensional analysis of the items, ensuring that the Portuguese version preserved the fidelity of the original content while being properly contextualized to the national reality.

The consensus reached and the suggestions provided focused only on linguistic and terminological adjustments, without requiring changes to the conceptual content. These findings are consistent with other cross-cultural adaptation studies (27,29), reinforcing the adequacy of the methodology adopted.

The pre-test, conducted with 35 nurses and specialist nurses, confirmed the clarity and usability of the questionnaire, with an average completion time of less than 10 minutes. This result is consistent with international recommendations on the acceptability of self-report health instruments, which emphasize the importance of brief, clear, and user-friendly questionnaires to increase adherence and reduce participant fatigue (14,31,32). The absence of relevant changes at this stage further reinforces the consistency of the pre-final version and its suitability for use in larger-scale studies.

Regarding internal structure, the extraction of seven factors, explaining 66% of the total variance, demonstrates the dimensional robustness of the Portuguese version of the APNCAI. After varimax rotation, all items presented adequate factor loadings ( $\geq 0.40$ ), confirming the coherence of the model. A noteworthy finding was the convergence of the "Quality Management" and "Care Management" dimensions into a single factor. Compared to the original validation study, which identified an eight-factor structure, the Portuguese version yielded a seven-factor solution. Despite this reduction, the overall conceptual integrity of the instrument was preserved. This result may be interpreted in light of the organization of professional nursing practice in Portugal and the quality standards defined by the

Portuguese Nursing Council (6,35). These regulatory documents often integrate quality as an inseparable component of care management, which may explain Portuguese nurses' perception that these domains constitute a unified area of competence. This finding represents a new and relevant contribution, showing how organizational and regulatory specificities influence the dimensional configuration of the instrument.

The naming of the extracted factors followed the conceptual framework of the original APNCAI and was based on the content of the items loading on each factor. Thus, the Portuguese version maintained theoretical alignment with the original domains, with the exception of the merged dimension. The distribution of items within each factor was consistent with their theoretical content, reinforcing the conceptual coherence of the extracted structure.

Some items deserve individual analysis. Item 26 showed an acceptable loading in the factor that merged quality and management, suggesting a practical association between mentoring/teaching activities and the promotion of continuous improvement. This interpretation is consistent with the Portuguese reality, where internal training processes are often articulated with the implementation of best practices and quality audits. Item 10, on the other hand, loaded more strongly on the factor related to research and evidence-based practice, reflecting its emphasis on innovation and knowledge production. These results suggest that, beyond capturing the overall competency structure, the APNCAI is sensitive to cultural and organizational specificities.

In the original Spanish validation study (10), both exploratory and confirmatory factor analyses supported an eight-dimension structure. In contrast, the present study identified a seven-factor solution, reflecting contextual adaptation rather than structural inconsistency.

The final Portuguese version of the APNCAI retained a seven-dimensional structure comprising 44 items. These dimensions included: Research and Evidence-

Based Practice (9 items: 1, 2, 3, 4, 5, 6, 7, 8, and 10); Clinical and Professional Leadership (3 items: 9, 11, and 12); Professional Autonomy (8 items: 13, 14, 15, 16, 17, 18, 19, and 20); Interprofessional Relationships and Mentorship (5 items: 21, 22, 23, 24, and 25); Teaching and Professional Education (4 items: 37, 38, 39, and 40); Health Promotion (4 items: 41, 42, 43, and 44); and an integrated domain reflecting the convergence of Quality Management and Care Management, which in the present study was conceptualized as Care and Quality Management dimension (11 items: 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, and 36).

Overall, the retained dimensions preserved the conceptual core of the original instrument. The integration of the Quality Management and Care Management domains suggests that, within the Portuguese context, competencies related to care coordination, quality assurance, and organizational responsibility are perceived as closely interconnected components of advanced nursing practice. Conceptually, this merged factor may be interpreted as an integrated Care and Quality Management domain, reflecting the organizational and regulatory specificities of the Portuguese healthcare system.

International comparisons show that the Brazilian validation of the APNCAI reported different results depending on the level of care. In hospital settings, the dimensional structure was maintained, similar to the original version(36). However, in primary healthcare, adaptations were required, resulting in a final version with 38 items distributed across eight dimensions(37). In the Portuguese context, all 44 items were retained, but two dimensions were merged, illustrating that contextual differences, particularly the integration of primary and hospital care in Local Health Units, may influence the factorial arrangements obtained. This comparison underscores the importance of considering the particularities of each health system when validating psychometric instruments.

Reliability analysis demonstrated excellent internal consistency. Cronbach's

alpha for the total scale was 0.960, while factor-level values ranged between 0.821 and 0.916, generally surpassing those reported in Brazilian validations (36,37). These results are in line with methodological literature, which considers values above 0.70 acceptable and those above 0.80 indicative of good reliability (17,21). In addition, corrected item–total correlations were adequate, and inter-item correlations remained within the recommended ranges, further supporting the psychometric robustness of the Portuguese version.

The results obtained have important implications for practice, education, and research in advanced practice nursing in Portugal. The availability of a validated instrument allows for rigorous evaluation of advanced practice nursing competencies, supporting not only the monitoring of professional development but also the identification of priority areas for continuing education. From a research perspective, the Portuguese version of the APNCAI opens new possibilities for multicenter and comparative studies, both nationally and internationally. In the field of health policy, its use may support evidence-based decision-making, underpinning the expansion of roles and the formal recognition of advanced practice nursing, in line with international recommendations from the ICN (1) and the OECD (3).

Overall, this study reinforces that the Portuguese version of the APNCAI is a valid, reliable, and culturally appropriate instrument, capable of assessing advanced practice nursing competencies in the country. Its use may contribute to the consolidation and recognition of this level of practice, strengthening the profession and supporting the continuous improvement of healthcare delivery in Portugal.

### ***Implications for practice, knowledge, and the profession***

The Portuguese version of APNCAI is a valid and reliable instrument for self-assessment and monitoring of competencies, supporting professional development plans,

mentoring processes, and quality improvement initiatives within healthcare services and units. The retention of all 44 items, combined with a factor structure adjusted to the Portuguese context, provides valuable insights into how management dimensions are conceptualized and operationalized within the National Health Service. This opens perspectives for future confirmatory studies and metric invariance analyses across different contexts (33,34).

### **Strengths and limitations**

This study presents as its main strength the use of widely recognized methodological frameworks for the cross-cultural adaptation of instruments, namely the guidelines of Beaton et al. (14) and the COSMIN recommendations (13), which ensured rigor and credibility throughout the process. Another relevant strength was the constitution of a qualified expert committee, which contributed to guaranteeing the semantic, idiomatic, cultural, and conceptual equivalence of the instrument. Additionally, the large and heterogeneous sample, applied within a Local Health Unit that integrates both primary and hospital healthcare, allowed for a greater diversity of professional contexts. The high internal consistency obtained across all dimensions further reinforces the psychometric robustness of the instrument.

Among the limitations, it is important to highlight the absence of confirmation from the original author of the instrument in the final stage, although the entire process was conducted with transparency, ethical principles, and documented communication. Furthermore, the sample was restricted to a single Local Health Unit in the northern region of the country, which may limit the generalizability of the results. The present study appropriately used Principal Component Analysis to explore the underlying structure of the instrument; however, future research should include confirmatory factor analyses, multicenter samples, and the assessment of structural invariance across different contexts and levels of care, while also exploring alternative rotation models and other

confirmatory techniques to refine dimensional interpretation(33,34).

## Conclusion

This study achieved the cross-cultural adaptation and validation of the Advanced Practice Nursing Competency Assessment Instrument for the Portuguese context through a rigorous methodological process. The Portuguese version demonstrated a consistent factor structure and high reliability, confirming it as a valid and reliable instrument for assessing advanced practice nursing competencies. Its use can support research, education, and health policy decision-making, contributing to the consolidation of advanced practice nursing in Portugal and to the continuous improvement of healthcare quality.

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## Conflict of interest

The authors declare no conflicts of interest.

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