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## Research Paper

## Reliability and validity of the Italian Version of the Chase Nurse Manager Competencies Scale



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## ABSTRACT

**Objectives:** This study aimed to translate and test the psychometric properties of the Chase Nurse Manager Competency Instrument (CNMCI) among Italian nurse managers and to provide further support for the scale's validity testing.

**Methods:** An instrument translation and cross-sectional validation study was conducted. The English version was translated into Italian using the translation method, which included pre-translation (establishing equivalence), initial translation, pretesting, review, and administration. From August 2022 to June 2023, 349 nurse managers were recruited through a web survey from 31 public and private healthcare organizations in North, Central, and Southern Italy. Validity assessments included content and structural validity. Reliability was evaluated using Cronbach's  $\alpha$  coefficient and test-retest reliability.

**Results:** The content validity confirmed all the items of the CNMCI in the Italian version, including the two measurement sections, "knowledge and understand" and "ability to implement and/or use." The instrument's item-content validity index (I-CVI) ranged from 0.83 to 1.00, while the scale-level content validity index (S-CVI) for both instrument sections was 0.97. The confirmatory factor analysis showed an acceptable fit. In the "knowledge and understand" section, Cronbach's  $\alpha$  coefficient was 0.978, and in the "ability to implement and/or use" section, Cronbach's  $\alpha$  coefficient was 0.976. The correlation coefficient between each dimension was 0.494–0.908. The test-retest reliability score was 0.82, suggesting good instrument consistency.

**Conclusions:** Overall, the Italian CNMCI demonstrates good reliability and validity for measuring nurse managers' core competencies and supports the construct's multi-dimensionality. Also, our findings support the hierarchical nature of the factors, further supporting the validity of the instrument.

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## What is known?

- There is an imperative need to assess and categorize competencies among nurse managers in healthcare settings, given their essential role in staff wellbeing and quality of care.
- The Chase Nurse Manager Competency Instrument (CNMCI) is a comprehensive assessment tool with good validity and

reliability. The instrument has been translated into three languages other than English.

## What is new?

- This study supports knowledge regarding the validity and reliability of the CNMCI, confirming that the instrument is reliable and valid in the Italian version.
- The study expands the psychometric evaluation of the instrument, supporting the use of different scoring systems: single-dimension scores, second-order scores, or the overall competency model scores.

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- The CNMCI can be used in training programs to evaluate managerial competencies or as an evaluation instrument during employment.

## 1. Introduction

Nursing management is pivotal in the healthcare ecosystem, serving as the backbone and ensuring clinical and administrative functions operate harmoniously [1]. The nurse manager role is multifaceted, encompassing leadership, organizational, and clinical competencies, all of which are vital for the effective functioning of healthcare institutions [2]. The main challenges managers face are the continuous organizational changes and high demands [3], managing conflict and unexpected crises, time management [4], maintaining a safe environment for the nursing workforce and their retention, and guaranteeing patients' satisfaction and quality of care [5]. Those challenges call into question the manager's abilities and competencies. To ensure responses to the complex needs of healthcare, appropriateness, quality, effectiveness, and efficiency in all activities, the development of leadership competencies in nursing is essential [6,7].

Research indicates that achieving competency as a manager in the nursing field requires more than seven years of experience [8]. Yet, many nurse managers step into their roles without formal leadership training. This gap between role assumption and leadership preparation leads to numerous challenges, including stress, decreased effectiveness in management, and negative outcomes [9–11]. These negative outcomes span low job satisfaction, high staff turnover, diminished engagement among staff members, deteriorating quality of care, and financial burdens for healthcare institutions. Given the current demands of healthcare, continuing in this manner is a relevant drawback for the sustainability of the ecosystems of healthcare systems.

The complexity of the role necessitates a well-defined set of "management competencies" that go beyond clinical expertise [2]. This term was defined as "the correct combination and application of the knowledge, attitudes, and skills of middle nurse managers in specific management functions, which are observed and measured as behaviors." [12] Moreover, a focus on competency development aids the professional growth of nurse managers, equipping them with the competencies needed to adapt to the evolving demands of the healthcare industry [13]. For these reasons, understanding and developing nurse manager competencies is the key to meeting the challenges of modern healthcare settings, benefiting nurse managers and their staff, patients, and the healthcare institutions they serve [14,15]. Consequently, assessing and categorizing competencies among nurse managers becomes imperative since they represent an invaluable resource for identifying, guiding, and training nurse managers [16].

Different competency models were proposed, and these multifaceted perspectives underscore the diverse dimensions of management competencies within the nursing profession [16]. For example, the Competency-Based Theory explains how organizations can develop a sustainable competitive advantage through the coordinated deployment of resources [17]. It incorporates competencies regarding economic, organizational, and behavioral concerns in a dynamic, systemic, cognitive, and holistic framework. Also, Katz's framework identifies three essential competencies for managers: technical, human, and conceptual, which are indispensable at different levels of management [18]. Additionally, the American Organization of Nurse Executives (AONE) has provided a conceptual framework that captures competencies in areas like communication, professionalism, knowledge, and business skills, all intersecting with leadership competencies [19].

These premises lead to the necessity of measuring the competency of nurse managers, resulting in the development of several assessment techniques and measurement scales. While significant advancements have been made in recent years, a noticeable gap exists in the literature concerning the scarce availability of tools, the methodologies employed for assessment, their correlation with nursing and patient outcomes, and the unverified reliability, making them unsuitable for practical application [20]. Therefore, to bridge these gaps in developing competent healthcare managers and leaders [21], efforts should focus on constructing rigorous pathways to equip managers with the requested competencies for current and future roles.

According to a recent systematic review aiming to summarize existing instruments measuring First-, Middle- and Top-Level nurse managers' competencies, a total of 10 instruments were identified [22]: the Chase Nurse Manager Competency Instrument that measures "knowledge and understand" and "ability to implement and/or use" competencies [23,24]; the Nurse Manager Competency Inventory that measures competencies in building cohesive teams [25]; the Human Capital Competencies Inventory for developing self, recruiting, developing others, utilizing and retaining [26]; the Home Health Care Nurse Manager Assessment Tool specific for local and home assistance [27]; the Competency Assessment Scale for Head Nurse, developed for community and tertiary hospitals [28]; the Nursing Informatics Competency Assessment for the Nurse Leader to assess a set of informatics competencies [29]; the Nurse Manager Evidence-based Practices (EBP) Competency Scale which is entirely focused on measuring Nurse Manager competencies regarding EBP [30]; the Questionnaire for Head Nurses' Managerial Competencies with four main managerial tasks: planning, organizing, leadership and control [14]; the Indonesian First-Line Nurse Managers' Managerial Competence Scale [12] and the Competency Elements for Nurse Managers of Tertiary General Hospitals in China [31]. Out of these instruments, the CNMCI emerged as the most comprehensive tool for assessing competencies [23,24].

The theoretical foundation of this study is based on an integrated approach that combines elements from competency-based theory, Katz's conceptual framework, and the AONE nurse manager leadership collaborative framework [17–19]. This integrated framework aligns with the conceptualization of the CNMCI, a synthesis of these theories and frameworks. Unlike the other tools just mentioned, the CNMCI distinguishes itself by its breadth, encompassing domains regarding competencies in technical skills, human interaction, conceptual thinking, leadership, and financial management [32–34]. Notably, each of the CNMCI domains is assessed from two perspectives (sections): "knowledge and understand" and "ability to implement and/or use." This dual assessment allows for the theoretical conceptualization of the scale as two distinct versions, although it is often treated as a single, unified scale. Consequently, one could argue that the instrument effectively encompasses ten domains, as each of the five principal domains is evaluated twice—one for knowledge and the other for practical application. The instrument serves various functions, including but not limited to self-evaluation and supervisory assessments. The instrument's quantitative approach facilitates the tracking of competency development, highlighting its utility for both novice and experienced nurse managers. Most importantly, the CNMCI has been successfully adapted and validated in different cultural and healthcare settings, further testifying its robustness and relevance [35–37]. The structured and empirically validated framework of the CNMCI contributes significantly to identifying key competencies vital for nurse managers [38,39]. This supports their professional development and enhances managerial effectiveness, improving patient care outcomes.

Italy's healthcare system is a regionally-based National Health

Service [6]. It provides universal coverage to citizens and residents, with public healthcare largely free. However, the system faces challenges such as regional disparities in healthcare quality, an ageing population, and the need for modernization. Therefore, nurse managers in Italy play a crucial role in navigating these complexities, making their competencies particularly important for the effective functioning of the healthcare system [19]. Especially after the COVID-19 pandemic, attention to this figure has increased exponentially in Italy, with several agreements and strategies implemented between scientific societies, professional orders, and state bodies. These proposed actions describe the evolution and development of new roles by consolidating middle management, strengthening nurse managers, adapting purposes and functions concerning other health and social care structures, and issuing guidelines for health professions. Within the Italian context, the absence of nurse manager-specific competency instruments and a lack of validated instruments from other languages have posed a significant impediment to the measurement of competencies among these managers [40–42].

Considering the evolving nature of healthcare management and the increasing need for contextually relevant competency assessment tools, it is particularly important to render an instrument that measures nurse manager competencies in Italian and to test its psychometric properties to facilitate an appropriate usage within this context. The study aimed to translate and test the psychometric properties of the CNMCI among Italian nurse managers and to provide further support for the validity testing of the scale. Successful validation of the CNMCI in the Italian context could reinforce the instrument's global applicability and contribute to developing more effective training and professional development programs for nurse managers, paving the way for future research and joint efforts. Ultimately, this research has the potential to positively impact nursing management practices, enabling nurse managers to identify and develop essential managerial skills.

## 2. Methods

### 2.1. Study design

This study was carried out in two stages. The first stage involves translating the CNMCI from English to Italian [43,44], while the second stage employs a cross-sectional multi-center design for psychometric testing of the scale.

### 2.2. Ethical approval

This study was conducted in compliance with the ethical standards and principles delineated in the Helsinki Declaration [45] and was approved by the local ethics committee (Number 002.23 [40.22] OSS). The board of directors at each participating center approved the study prior to administering the questionnaire. All participants received adequate study information and signed the informed consent form. Data access was restricted solely to the research team.

### 2.3. Translation procedure

Before the translation procedure, the authors requested consent from the developing author for use. The translation and cultural adaptation of the CNMCI from its original language to Italian was executed through a collaborative and iterative process, following the methodological steps described by Douglas and Craig [46]. The translation process was divided into five key stages: pre-translation (establishing equivalence), initial translation, pretesting, review, and administration. The Italian version was forwarded to the

original scale developer for final approval of the Italian adaptation before survey administration. 1) In the pre-translation stage, a multidisciplinary team of experts was assembled to establish the conceptual definition of the contents included in each scale item. The focus was on achieving category, functional, and construct equivalences. Category equivalence pertains to the similarity of categories used to describe phenomena across different cultures. Functional equivalence assesses whether the research instrument functions similarly in different cultural groups. Construct equivalence concerns the underlying meaning or concept studied across different cultural groups. Achieving these types of equivalence was the primary aim of the pre-translation stage. The team comprised 12 experts, including a psychologist, a human resource specialist, four nurse managers, and six staff nurses. All of them were knowledgeable and had over ten years of work tenure. During team meetings, the content of various items within specific sub-scales underwent minor linguistic modifications to align them with Italian nurse managers' professional terms and common actions, aiming to reduce ambiguity. For example, in item 2, the term "care delivery systems" was modified to "models of care," in item 8, "new" technology was replaced by "innovative" technology; in item 12, "effective communication" was replaced by "effective communication techniques," and in item 23, the term "use of" was added to the "humor" item. 2) After ensuring the equivalence of items, an initial translation was performed independently by two translators experienced in translating self-reporting questionnaires. The expert panel then reviewed this translation to ensure that the meaning of each item was accurately captured in Italian. 3) The pretesting stage involved authors who did not participate in the initial translation. They reviewed the translated items to ensure clarity, relevance, and cultural appropriateness for the Italian healthcare setting. 4) A comprehensive review meeting was held with the translators, the expert panel, and the authors. This meeting aimed to finalize the Italian version of the CNMCI, ensuring that each item accurately captured its intended meaning. 5) Following the review, the translated and adapted CNMCI was administered in a pilot test involving 30 manager volunteers not included in the study sample. This was done to ensure the clarity of the final Italian version of the scale.

### 2.4. Scale evaluation and validation procedure

#### 2.4.1. Study setting and participants

The primary aim of this study is to validate the CNMCI among nurse managers working in various healthcare settings across different regions of Italy. These settings include, but are not limited to, public hospitals, private clinics, specialized care units, and community healthcare centers. Including such a wide range of settings aimed to provide a thorough understanding of the instrument's applicability within this specific group. Nurse managers were recruited from September 2022 to June 2023.

The inclusion criteria were as follows: 1) employed in a public or private healthcare organization; 2) have been in their current managerial role for at least one year. Participants were excluded from the study if they were not assigned to a stable work setting. The sampling method for this study was convenience-based, and participation was voluntary.

In consideration of the analytical approach employed in this study, which is based on Confirmatory Factor Analysis (CFA), the sample size was carefully determined to ensure statistical power and model fit. The process involved specifying the Root Mean Squared Error of Approximation (RMSEA) as a critical criterion for model fit alongside other key parameters [47]. The desired RMSEA was set at a lower bound of its interval confidence equal to 0.02, indicative of a good fit between the hypothesized model and the

observed data. The CFA model included 53 items distributed among 5 factors in the first model and 106 items and 10 factors in the second model. The significance level ( $\alpha$ ) was set at 0.05, applying a two-tailed test, with a power ( $1 - \beta$ ) of 90%, aiming to minimize the risk of Type II errors—failing to detect an effect that is present. An expected dropout rate of 10% was factored into the calculations to adjust the sample size accordingly, ensuring robustness against potential data loss. The degree of freedom ( $df$ ), a critical component in determining the RMSEA, was calculated based on the formula for degrees of freedom in CFA:  $df = [\text{number of items} * (\text{number of items} + 1)/2] - \text{number of estimated parameters}$  [48]. This calculation yielded a  $df$  of 1,431 (model 1) and 5,671 (model 2) for our model configurations. Utilizing the sample size calculation approach advocated by Kim [48], which considered the non-centrality parameter and the anticipated model misspecification under the null hypothesis, the initial sample size necessary to achieve the set power and RMSEA was determined to be 296 in model 1 and 337 in model 2. Involving different thresholds of RMSEA, the sensitivity analysis indicated that this study's sample size should be between 310 and 380 participants.

#### 2.4.2. Measurements

**2.4.2.1. The general data questionnaire.** Several demographic and professional variables were collected to describe the sample comprehensively. This included age, sex, educational background, nurse tenure, manager tenure, and the region of Italy where participants work.

**2.4.2.2. The Italian version of the Chase Nurse Manager Competency Instrument.** After accurate translation and content validation in Italian, the original version of the CNMCI was retained, with modifications and adjustments made to certain items to ensure respondents could accurately comprehend the statements and provide reliable answers. The scale comprises 53 items related to nurse manager competencies; each item is evaluated in the “knowledge and understand” section and the “ability to implement and/or use” section. In each section, the items are organized into five dimensions: technical (items 1–11), human relations (items 12–24), conceptual (items 25–32), leadership (items 33–46), and financial management (items 47–53). The scale employs a 4-point Likert-type scoring system for both “knowledge and understand” and “ability to implement and/or use” sections where each managerial competence is rated for its importance as 4 = is essential, 3 = contributes significantly, 2 = contributes moderately, 1 = contributes minimally. The score for each section is calculated as the sum of item scores, and the total score ranges from 53 to 212. The overall CNMCI score is computed as the sum of the two section scores, and the possible CNMCI overall scores range from 106 to 424. The CNMCI is a reliable and valid instrument. In the two studies of the original instrument development, Cronbach's  $\alpha$  coefficient reported was 0.950 [24] and 0.941 [23] for the knowledge and understand section, 0.909 [24] and 0.933 [23] for the ability to implement and/or use section; 0.954 [24] and 0.965 [23] for the overall CNMCI. The CNMCI has a five-factor structure for each section (knowledge and understand; and ability to implement and/or use) [23,24].

#### 2.4.3. Data collection

The principal investigators promoted the study through the network of the Italian Association of Nurse Managers (SIDMI). The association has utilized its extensive network to invite members across various regions and healthcare settings to express interest in the research. Nurse executives who expressed interest in the study were invited to an online meeting with the researchers, during which detailed explanations were provided. Subsequently, each

nurse executive interested in the study contacted the researchers for operational instructions on conducting it in their healthcare setting. A designated local contact person was identified at each participating center, who explained the study's objectives and procedures to nurse managers within the healthcare organization and encouraged their participation. Data was collected from August 2022 to June 2023 using an online survey hosted on the Google Forms platform. The data collection began with an introductory section that explained the study's aims and the process for participation. This was followed by sections for informed consent and data treatment, ensuring that participants were fully aware of the study's scope and their rights as participants. All data was collected anonymously to maintain the participants' confidentiality and encourage honest and open responses. Overall, 400 nurse managers were enrolled in the study, and 349 responses were received, indicating a response rate of 87.2%.

#### 2.4.4. Data analysis

The statistical processing of the results was performed using Mplus version 8.1 [49], and data visualization was conducted using R version 4.2.2. In all analyses, the statistical significance was set at  $P < 0.05$ . Descriptive statistics were used to summarize the demographic and sample data analyzed in the study. Continuous data were tested for normality distribution and were presented as the mean and standard deviation (SD). Frequencies and percentages were used to describe categorical variables.

Content and structural validity were assessed. The scale's content was assessed for relevance and comprehensiveness through a focus group involving nurse managers and other experts. The authors consulted a panel of 12 experts in the field, including a psychologist, a human resource specialist, four nurse managers, and six staff nurses. The expert group members were knowledgeable and had more than ten years of work tenure. Each expert evaluated the scale items' relevance, clarity, and comprehensiveness based on a score from 1 to 4 where 1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, and 4 = highly relevant. For each item, the item content validity index (I-CVI) and for each CNMCI section (knowledge and understand; and ability to implement and/or use) scale content validity index S-CVI were computed [50,51]. The I-CVI is determined by the proportion of agreement regarding relevance calculated as the ratio of experts who rated items 3 or 4 to the total number of experts. The S-CVI is computed by averaging the I-CVI scores across all items. Scores equal to or higher than 0.80 in I-CVI and S-CVI were considered acceptable [50,51]. Following, a qualitative exploration with a focus group carefully evaluated the clarity and comprehensiveness of the scale items based on participants' expertise and experience. Researchers asked the experts about the comprehensibility and clarity of items; particular attention is given to items that score less than 0.80, which can be restructured more comprehensively, maintaining linguistic equivalence. Any discrepancies were carefully examined to understand the reasons behind differing opinions or interpretations of the scale's items or content, reach a consensus, and clarify any misunderstandings or conflicting viewpoints regarding the items' relevance, clarity, or appropriateness.

The structural validity of the Italian-CNMI was evaluated using CFA models, as well as internal consistency and reliability. Given the pre-existing theoretical framework of the CNMCI [20,21], this study sought to confirm, rather than explore the dimensionality of this instrument within an Italian nursing context. Under this perspective, CFA was considered the most appropriate statistical technique for hypothesis-driven validation. Two different strategies were employed to confirm the dimensionality of the CNMCI. Initially, separate CFA models were constructed for “knowledge and understand” and “ability to implement and/or use” sections. These models were estimated using the robust unweighted least squares mean and

variance-adjusted estimator (ULSMV) [52]. This approach allowed us to handle non-normal data and missing values effectively. The missing data was less than 5% for each item, and no imputation techniques were required. The fit of these models was assessed using Chi-square ( $\chi^2$ ), the Comparative Fit Index (CFI), the Tucker-Lewis index (TLI), and the RMSEA. A non-significant  $\chi^2$  value indicates a good model fit. However, this test is sensitive to sample size, so it is often used with other fit indices. Values for CFI and TLI range between 0 and 1; a value closer to 1 indicates a better fit. RMSEA values range between 0 and 1, with lower values indicating better model fit. An RMSEA value of 0.06 or lower is generally considered to indicate a good fit, while values up to 0.08 represent reasonable approximation errors. Given that total scoring for “knowledge and understand” and “ability to implement and/or use” sections appeared plausible; we also tested second-order CFA models. In each scale section, these models hypothesize second-order factors that predict the five domains (i.e., technical skills, human relations skills, conceptual skills, leadership skills, and financial management). Fit indices were again employed to evaluate the models. Bootstrapping methods were used to compare the first-order and second-order CFA models since the models were non-nested [53]. Specifically, 500 bootstrap samples were generated for each model to compute confidence intervals for fit indices such as CFI, TLI, and RMSEA. Non-overlapping confidence intervals between models for a specific fit index would indicate a significant difference in model fit.

As a second strategy, we aimed to examine whether a unified model involving both versions of the scale (comprising 106 items and 10 domains) could be supported. This investigation helped us confirm whether the CNMCI could be conceptualized as a single, unified scale. Factor loadings for all the CFA models were reported using a fully standardized solution and their standard errors (SE).

The internal consistency of each scale's section was assessed using Cronbach's  $\alpha$  coefficient, employed at each scale domain, second-order domains, and the “knowledge and understand” and “ability to implement and/or use” sections. A Cronbach's  $\alpha$  coefficient of 0.70 can be considered acceptable; however, values between 0.80 and 0.95 are preferred for the psychometric quality of the scales [54].

The test-retest analysis evaluated the reliability of the scale. The instrument was administered to 30 managers twice, with a one-week interval between the first and second sessions. The Intra-class Correlation Coefficient (ICC) between the two-time points measurements was calculated to define the instrument's reliability over time. The ICC and the 95% confidence intervals (CIs) were calculated based on a 2-way mixed-effects model, looking for consistency among the mean rating of 30 measurements to determine the test-retest reliability. The ICC values less than 0.5, between 0.5 and 0.75, 0.75 and 0.90, and greater than 0.90 indicate poor, moderate, good, and excellent reliability, respectively [55].

### 3. Results

#### 3.1. Characteristics of the participants

Sample characteristics are shown in Table 1. The sample ( $n = 349$ ) for this study was geographically diverse, with participants hailing from 31 healthcare organizations, both public and private, from various regions across Italy similarly represented: North 30.7%, Central 35.5%, and 33.8% from Southern Italy. Regarding sex distribution, the sample was predominantly female (75.4%), and the mean age of the participants was ( $52.42 \pm 6.75$ ) years. Educational background varied among participants, with a significant majority (60.5%,  $n = 211$ ) having completed a bachelor's degree. The nurse managers had a previous mean work experience ( $24.00 \pm 9.75$ ) years as a registered nurse and a median managerial

**Table 1**  
Socio-demographic characteristics of participants ( $n = 349$ ) and healthcare setting.

Characteristics	<i>n</i>	%
Sex		
Female	263	75.36
Male	86	24.64
Geographical area		
South	107	30.66
Central	124	35.53
North	118	33.81
Education level		
Bachelor's degree	35	10.03
Post Bachelor certification	211	60.56
Master's degree	64	18.34
Post Master certification	37	10.60
PhD	2	0.57
Healthcare organization typology <sup>1)</sup>		
Public	20	64.50
Private	11	35.50
Healthcare organization geographical distribution <sup>1)</sup>		
South	9	29.00
Central	11	35.50
North	11	35.50

Note: Post Bachelor/Master certification is referred to a university education consisting only in 60 ECTS which allows students to acquire a deeper knowledge on a specialty; it is not classified as a university degree but rather as a certification of a qualification in a specific area. <sup>1)</sup>  $n = 31$ .

tenure of 5 years (3, 16). The number of staff managed per nurse manager ranged from 5 to 50. Regarding the CNMCI “knowledge and understand” section, the total score was ( $177.0 \pm 23.0$ ) and for the “ability to implement and/or use” section, the total score was ( $183.0 \pm 21.0$ ).

#### 3.2. Validity

##### 3.2.1. Content validity

The relevance, clarity, and comprehensiveness of the 53 instrument items in the “knowledge and understand” and “ability to implement and/or use” sections were discussed during the face and content validity of a survey, focus group, and expert meetings. The I-CVI varied between 0.83 and 1.00, while the S-CVI for the “knowledge and understand” and “ability to implement and/or use” sections was 0.97. These findings suggest strong content validity of the Italian CNMCI.

##### 3.2.2. Structural validity

Fig. 1 presents the CFA models and factor loadings in the five dimensions of the CNMCI for “knowledge and understand” and in Fig. 2, those for the “ability to implement and/or use” sections.

**3.2.2.1. CFA for the “knowledge and understand” section.** The posited model well explained sample statistics:  $\chi^2(1,315, n = 349) = 2033.753, P < 0.001$ ; CFI = 0.973; TLI = 0.972; RMSEA = 0.040 (95% CI = 0.036–0.043). Factor loadings ranged from 0.590 to 0.943, with associated standard errors indicating high precision (Table 2).

The model fit statistics were as follows:  $\chi^2(1,320, n = 349) = 2,098.424, P < 0.001$ ; CFI = 0.969; TLI = 0.968; RMSEA = 0.041 (95% CI = 0.038–0.044). Factor loadings were significant and ranged from 0.608 to 0.952, closely mirroring the results of the first-order CFA. Furthermore, the second-order factor (Knowledge) effectively predicted the variances of the five first-order competency domains, with loadings ranging from 0.765 to 0.950. After performing bootstrapping for model comparison, the confidence intervals of fit indices overlapped, suggesting that there were no significant differences between the models.

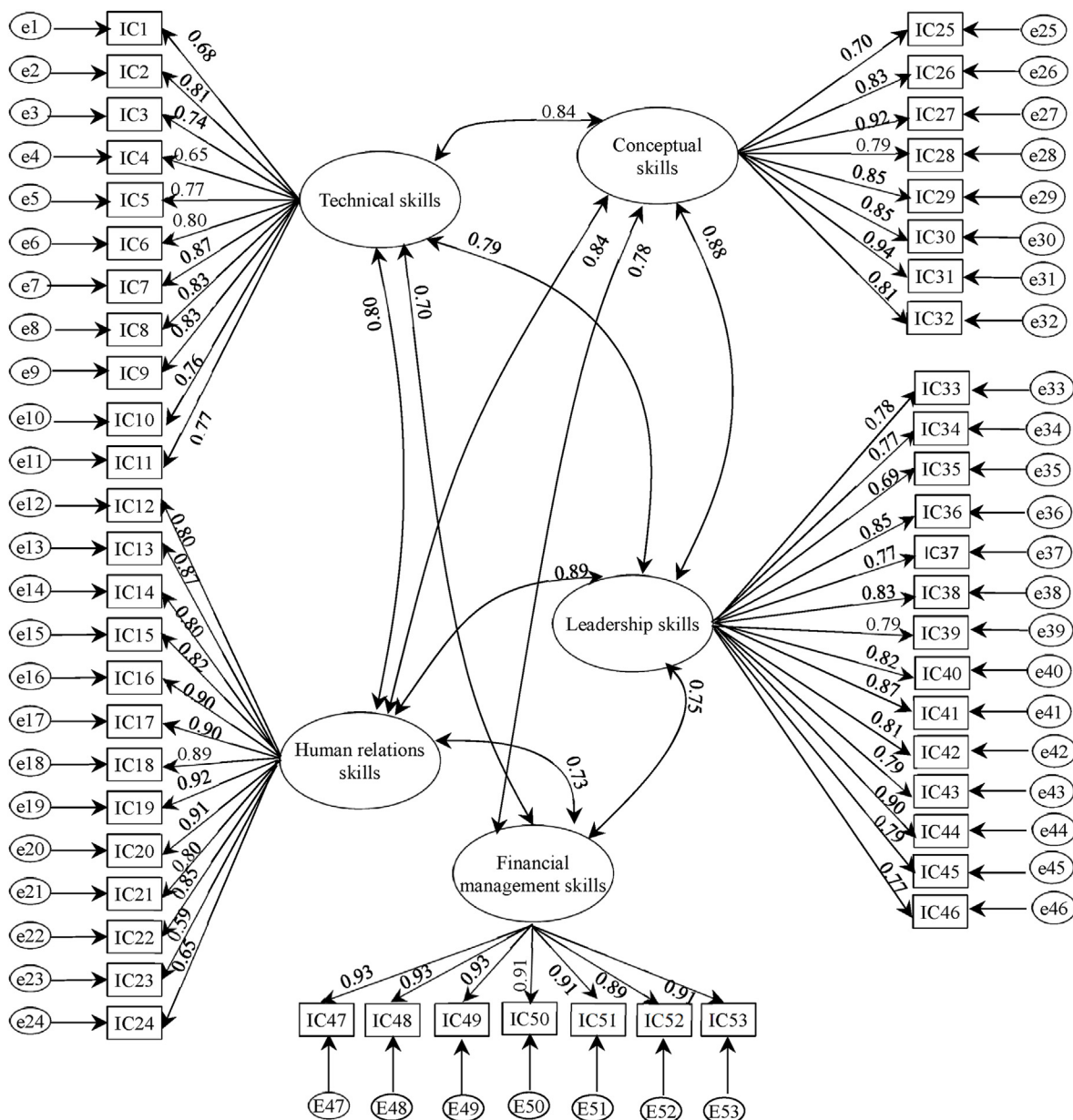


Fig. 1. Confirmatory factor analysis of the Italian version of the Chase Nurse Managers Competency Instrument, “knowledge and understand” section.

3.2.2.2. CFA for the “ability to implement and/or use” section. The model for the “ability to implement and/or use” section of the scale exhibited excellent fit to the data:  $\chi^2$  (1,315,  $n = 349$ ) = 2046.148,  $P < 0.001$ ; CFI = 0.971; TLI = 0.969; RMSEA = 0.040 (95% CI = 0.037–0.043). Factor loadings were significant and ranged from 0.607 to 0.953, with associated standard errors underscoring the precision of these estimates (Table 2).

The second-order CFA demonstrated an excellent fit to the data as well. The model fit statistics were as follows:  $\chi^2$  (1,320,  $n = 349$ ) = 2047.320,  $P < 0.001$ ; CFI = 0.973; TLI = 0.972; RMSEA = 0.040 (95% CI = 0.036–0.043). Factor loadings were significant, ranged from 0.591 to 0.950, and were very similar to the ones shown by the first-order CFA. In addition, the second-order factor (Implementation) positively predicted the variances of the five first-order factors, with loadings ranging from 0.801 to 0.950. After performing bootstrapping for model comparison with the first-order CFA, the confidence intervals of fit indices overlapped,

suggesting that there were no significant differences between the models.

3.2.2.3. Overall models. The model performed well on 106 items and 10 domains, as explained by the sample:  $\chi^2$  (5,414,  $n = 349$ ) = 8048.195,  $P < 0.001$ ; CFI = 0.959; TLI = 0.958; RMSEA = 0.037 (95% CI = 0.036–0.039). All factor loadings ranged from 0.494 to 0.952, with SE ranging from 0.013 to 0.045. Significant correlations were observed between various factors, ranging from 0.494 to 0.908.

### 3.3. Reliability

#### 3.3.1. Internal coherence reliability and item analysis

3.3.1.1. Cronbach’s  $\alpha$  coefficient: “knowledge and understand” section. The Cronbach’s  $\alpha$  coefficient for the various domains of the “knowledge and understand” section were as follows: technical

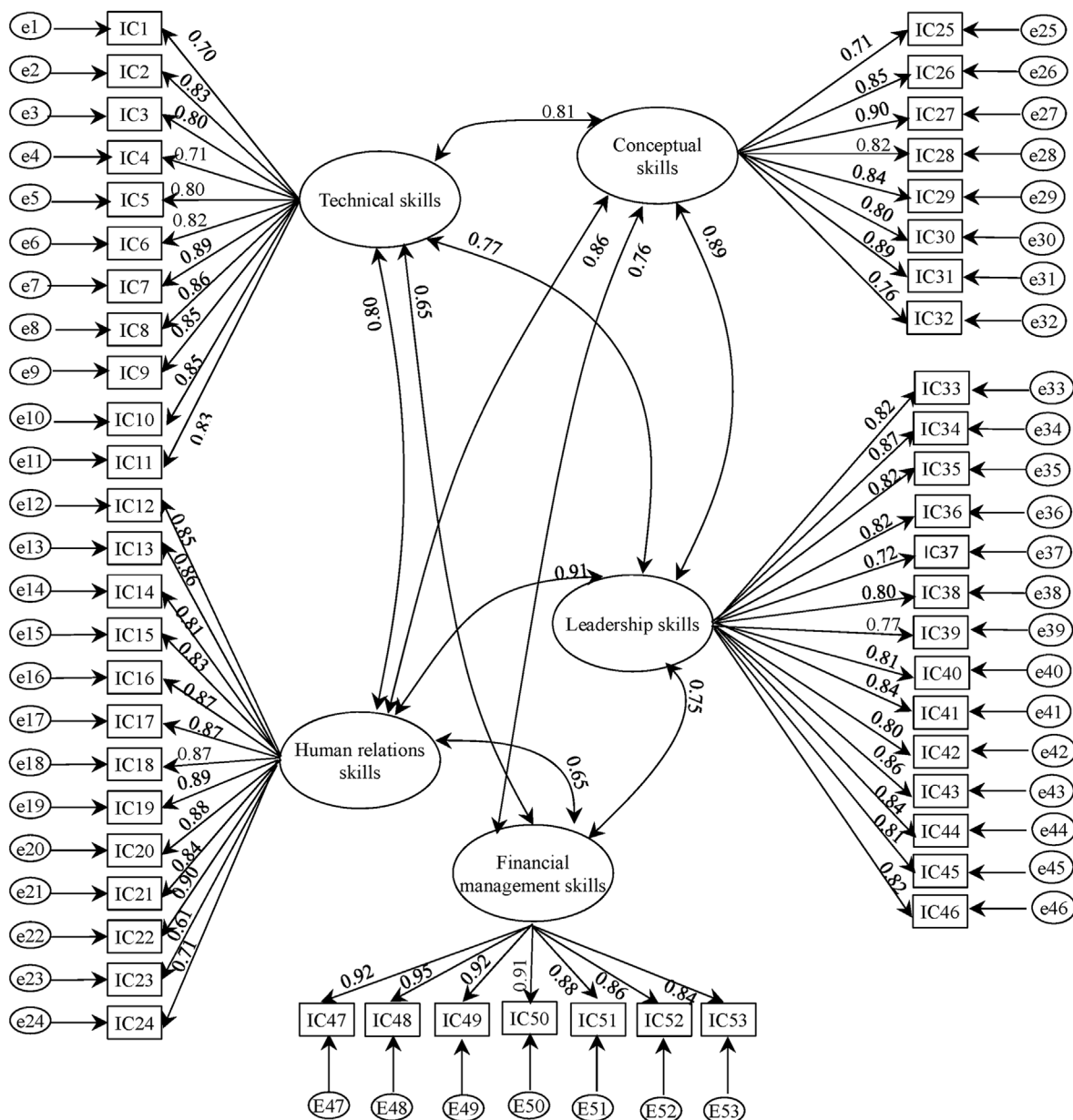


Fig. 2. Confirmatory factor analysis of the Italian version of the Chase Nurse Managers Competency Instrument, "ability to implement and/or use" section.

(0.922); human relations skills (0.940); conceptual skills (0.909); leadership skills (0.938); and financial management (0.938). The Cronbach's  $\alpha$  for the overall "knowledge and understand" section was 0.978.

3.3.1.2. Cronbach's  $\alpha$  coefficient of "ability to implement and/or use" section. The Cronbach's  $\alpha$  coefficient for the various domains of ability to implement and/or use section were as follows: technical (0.898); human relations skills, (0.933); conceptual skills (0.907); leadership skills (0.928); and financial management (0.944). The Cronbach's  $\alpha$  for the overall "ability to implement and/or use" section was 0.976.

3.3.1.3. Correlations of "Knowledge and understand" section. The correlations between various competency domains of the

"knowledge and understand" section were also significant. Specifically, the correlation between human relations skills and technical skills was strong at 0.801 ( $P < 0.001$ ). Conceptual skills displayed a high correlation with both technical skills ( $r = 0.843, P < 0.001$ ) and human relations skills ( $r = 0.838, P < 0.001$ ). Leadership skills were also strongly correlated with technical skills ( $r = 0.789, P < 0.001$ ), human relations skills ( $r = 0.915, P < 0.001$ ), and conceptual skills ( $r = 0.881, P < 0.001$ ). Financial management skills showed moderate to strong correlations with technical skills ( $r = 0.698, P < 0.001$ ), human relations skills ( $r = 0.732, P < 0.001$ ), conceptual skills ( $r = 0.782, P < 0.001$ ), and leadership skills ( $r = 0.750, P < 0.001$ ).

3.3.1.4. Correlations of "ability to implement and/or use" section. The correlations between the various domains of the ability to

**Table 2**  
Confirmatory factor analysis models of the Chase Nurse Manager Competencies Instrument.

Dimensions	Items	Knowledge and understand		Ability to implement and/or use	
		Factor loading	SE	Factor loading	SE
Technical	IC1	0.682	0.040	0.697	0.045
	IC2	0.811	0.031	0.828	0.028
	IC3	0.742	0.038	0.801	0.031
	IC4	0.650	0.041	0.711	0.036
	IC5	0.769	0.034	0.797	0.031
	IC6	0.706	0.044	0.823	0.030
	IC7	0.870	0.026	0.892	0.026
	IC8	0.830	0.031	0.864	0.024
	IC9	0.825	0.029	0.854	0.025
	IC10	0.756	0.037	0.848	0.026
Human relations	IC11	0.770	0.037	0.828	0.032
	IC12	0.802	0.028	0.846	0.023
	IC13	0.872	0.022	0.861	0.024
	IC14	0.803	0.027	0.811	0.025
	IC15	0.821	0.025	0.828	0.027
	IC16	0.896	0.020	0.870	0.023
	IC17	0.905	0.020	0.871	0.018
	IC18	0.894	0.020	0.871	0.019
	IC19	0.923	0.018	0.888	0.019
	IC20	0.912	0.019	0.876	0.020
Conceptual	IC21	0.802	0.027	0.839	0.023
	IC22	0.846	0.024	0.904	0.020
	IC23	0.590	0.042	0.607	0.039
	IC24	0.651	0.039	0.712	0.033
	IC25	0.700	0.037	0.715	0.033
	IC26	0.828	0.023	0.854	0.020
	IC27	0.923	0.018	0.904	0.017
	IC28	0.787	0.029	0.823	0.025
	IC29	0.853	0.024	0.844	0.024
	IC30	0.853	0.021	0.798	0.024
Leadership	IC31	0.943	0.018	0.887	0.019
	IC32	0.811	0.028	0.764	0.033
	IC33	0.783	0.028	0.816	0.026
	IC34	0.770	0.030	0.873	0.021
	IC35	0.686	0.035	0.817	0.025
	IC36	0.854	0.025	0.816	0.024
	IC37	0.770	0.032	0.725	0.033
	IC38	0.828	0.029	0.795	0.028
	IC39	0.750	0.034	0.771	0.029
	IC40	0.819	0.026	0.806	0.026
Financial management	IC41	0.871	0.022	0.837	0.023
	IC42	0.811	0.026	0.802	0.027
	IC43	0.794	0.027	0.857	0.021
	IC44	0.904	0.023	0.840	0.024
	IC45	0.789	0.027	0.810	0.023
	IC46	0.776	0.026	0.823	0.021
	IC47	0.929	0.025	0.916	0.026
	IC48	0.934	0.026	0.953	0.022
	IC49	0.927	0.019	0.925	0.021
	IC50	0.908	0.023	0.908	0.022
	IC51	0.906	0.023	0.877	0.027
	IC52	0.893	0.022	0.859	0.028
	IC53	0.908	0.020	0.837	0.028

Note: SE = standard error.

implement and/or use section and their respective competencies were also significant and positive. The correlation between human relations skills and technical skills was 0.802 ( $P < 0.001$ ). Similarly, conceptual skills were highly correlated with both technical skills ( $r = 0.812$ ,  $P < 0.001$ ) and human relations skills ( $r = 0.858$ ,  $P < 0.001$ ). Leadership skills also showed strong correlations with technical skills ( $r = 0.766$ ,  $P < 0.001$ ), human relations skills ( $r = 0.892$ ,  $P < 0.001$ ), and conceptual skills ( $r = 0.891$ ,  $P < 0.001$ ). Financial management had moderate to strong correlations with technical skills ( $r = 0.646$ ,  $P < 0.001$ ), human relations skills ( $r = 0.654$ ,  $P < 0.001$ ), conceptual skills ( $r = 0.758$ ,  $P < 0.001$ ), and leadership skills ( $r = 0.754$ ,  $P < 0.001$ ).

### 3.3.2. Test-retest reliability

The test-retest results confirmed an ICC of 0.82 and a 95% confidence interval ranging between 0.78 and 0.86, affirming the good reliability of the instrument in the new cultural and linguistic context.

## 4. Discussion

This study presented an exhaustive translation, structural validity, and reliability of validating the Italian version of the CNMCI. The scale was comprehensive, clear, and easy to use to measure competencies among nurse managers in Italy. Additionally, the instrument showed good dimensionality, internal consistency, and reliability. This research also added interesting novelties that acknowledged the application of first- and second-order CFAs. The CFA models demonstrated excellent fit across both the “knowledge and understand” and “ability to implement and/or use” sections, confirming the multidimensional nature of these competencies and the statistical strength of the tool when translated into Italian.

A methodical approach, openness, and rigorous adherence to translation and cross-cultural validation requirements for research instruments determine the validity, reliability, and quality of translated instruments. This study carried out these criteria because standard operating procedures were followed, comprehensive records were kept, and persons with clinical and research backgrounds were involved. The translated instrument exhibited exceptional content validity and maintained consistency with the original English CNMCI. Minor wording adjustments were made to the Italian version. All conceptual domains were considered pertinent for nurse managers’ competencies in Italy, as they are for the English-speaking population.

Unlike previous studies [23,24,35–37] that have often lacked in-depth psychometric analyses, this research delves into a more detailed level of psychometric scrutiny. Indeed, the CNMCI was translated and adapted previously by Slovenian, Ghanaian, and Israeli researchers [35–37]. These studies reported only a first-order CFA, internal consistency testing, item-to-total correlation, and significance correlation levels between groups. This study, conducted with a larger group of nurse managers, supports the findings of those earlier studies and expands the understanding by introducing a second-order CFA. This additional analysis could significantly influence the level of available evidence regarding the psychometric characteristics of the scale.

The use of bootstrap comparisons between first-order and second-order CFA provided empirical support for the scoring procedures for both first- and second-order factors. The two models did not significantly differ in explaining sample statistics. This is crucial because it validates the construct’s multi-dimensionality and supports the hierarchical nature of the previously employed factors without this validity evidence [10]. In other words, given that both first- and second-order CFAs were supported, practitioners and researchers have the flexibility to use either scoring approach depending on their specific research questions or practical needs. This versatility in scoring is a significant advancement in the field.

Furthermore, this study confirmed the strong internal consistency of the instrument. The findings demonstrate that all items within the instrument showed high levels of consistency among themselves and the overall dimension and instrument section. According to the results, all items had high item-to-item and item-to-instrument coherence levels. Furthermore, the study’s internal consistency (Cronbach’s  $\alpha$  coefficient) for the overall instrument sections in both original versions exceeded 0.970, suggesting high internal consistency. Additionally, the test-retest results established the instrument’s reliability in the new cultural and linguistic



context.

Overall, the instrument presents high content and construct validity. This study's findings resonate with existing literature that emphasizes the multifaceted role of nurse managers and the need for a comprehensive set of competencies [1,12]. Therefore, this study significantly contributes to the understanding of competency levels among nurse managers, reaffirming the existing literature findings on the multifaceted nature of managerial competencies [54,55].

In this study, competency levels display variability across the “knowledge and understand” and “ability to implement and/or use” sections. Specifically, higher scores are noted in the technical and leadership dimensions, both in terms of knowledge and practical application, mirroring findings from another study [10]. Conversely, human resource, conceptual, and financial competencies exhibit lower scores, contrasting with other studies [33,56], where human and leadership skills are ranked as the most important for nurse managers. This data suggests improving abilities, skills, and capabilities within these competency areas [57]. This improvement is essential for appropriately managing human resources and enhancing the ability to respond to local and global needs [58]. Additionally, the competencies explored in this study might form the body of knowledge required for the job of a nurse manager employed, not only in the Italian context but worldwide.

## 5. Strengths and limitations

The study's main strength, in addition to the thorough validity analysis, regards the sample size and the variety of nurse managers included. Indeed, we recruited managers from various settings, such as community care, hospitals, and private and public organizations, and this allowed us to include managers with various competencies in the psychometric analysis. This allows for a definition of core competencies for nurse managers independent of their work setting. This is one of the few studies directly assessing competencies among nurse managers and aims to shed light on this concept. Additionally, the study enhanced an understanding of the psychometric validity of CNMCI, supporting its applicability as an overall scale by aggregating scores from individual items across both “knowledge and understand” and “ability to implement and/or use” sections.

However, some limitations of this study need to be considered. The convenience sampling method restricts generalizations of findings to all nurse managers in Italy or other countries. This could have led to the inclusion of nurse managers who were particularly interested in the research topic or had closer relationships with nurse executives, possibly resulting in participation influenced by social desirability. Moreover, the cross-sectional design of the study does not allow us to assess the stability of the scale over time. Therefore, future research should focus on measuring scale stability using longitudinal designs and evaluate the cross-cultural invariance testing of the CNMCI in diverse samples of managers from various countries. Furthermore, while our study extensively focused on the structural validity of the CNMCI through CFA for both “knowledge and understand” and “ability to implement and/or use” sections, we acknowledge that a comprehensive exploration into other forms of validity, such as convergent, discriminant, and concurrent validity, were beyond the scope of this research. Hence, future studies could further evaluate criterion and discriminant validity by comparing CNMCI with other competency scales designed for nurse managers. Additionally, although our study demonstrated strong internal consistency for the CNMCI as indicated by high Cronbach's  $\alpha$  coefficients, a detailed analysis of other reliability measures was not conducted. Therefore, future research should not only focus on the measurement of the scale's

stability using longitudinal designs but also explore these additional aspects of validity and reliability. Such research would provide a more holistic understanding of the CNMCI's validity and reliability across different contexts.

Despite the acknowledged importance and the emergency of healthcare management competency as a field of study in recent years [54], there has been a shortfall in adequately understanding and addressing the competency requirements of healthcare managers. This highlights the need for further research to facilitate a more focused and purposeful approach to developing the competencies necessary for effective healthcare management.

There is a need to reform the present nurse manager selection methods centered on merit rather than competency [58]. Our findings may potentially guide nurse manager selection. There should also be a learning and professional development pathway for nurses before they work at the level of management [59]. In this study, a set of competencies were highlighted that we recommend being considered while training and selecting nurse managers. Nurse managers can develop their management duties by acquiring competencies that require a higher level of responsibility. As a result, nurse managers can be chosen based on these capabilities and their level of growth by utilizing the most-cited competencies as a starting point. This ensures the most qualified people are assigned managerial roles [60–63].

## 6. Conclusion

The Italian version of the CNMCI has demonstrated its ability to maintain and confirm the original version's responsiveness, reliability, and validity. Additionally, researchers can use the single factor and instrument scores for “knowledge and understand” and “ability to implement and/or use scale” sections separately in future empirical studies or choose to calculate the full-scale scores as first-order factor. The Italian version of the CNMCI is suitable for future empirical studies by executive managers, leaders, and healthcare researchers in Italy. Scale validation allows for thorough use in future research to evaluate the impact of nurse manager competencies on staff outcomes and patient quality of care. Additionally, it could be interesting to use the scale to differentiate competency scores between the three levels of management (First-Line, Middle, and Top). The scale can be further tested in the future researches to explore additional psychometric properties, such as criterion validity and stability, or for validation in longitudinal studies.

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## Data availability statement

The datasets generated during the current study are not publicly available due to institutional restrictions but are available from the corresponding author upon reasonable request.

## CRedit authorship contribution statement

**Dhurata Ivziku:** Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing, Supervision, Funding acquisition, Project administration. **Lucia Filomeno:** Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing. **Daniela Forte:**

Data curation, Investigation, Writing – original draft, Writing – review & editing. **Rosario Caruso:** Methodology, Validation, Formal analysis, Writing – original draft, Writing – review & editing. **Gianluca Conte:** Validation, Formal analysis, Writing – review & editing. **Arianna Magon:** Validation, Formal analysis, Writing – review & editing. **Raffaella Gualandi:** Conceptualization, Writing – review & editing. **Marco Di Muzio:** Supervision, Writing – review & editing, Project administration. **Daniela Tartaglini:** Conceptualization, Supervision, Writing – review & editing, Funding acquisition, Project administration.

## Declaration of competing interest

The authors declare that they have no competing interests.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijnss.2024.06.001>.

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